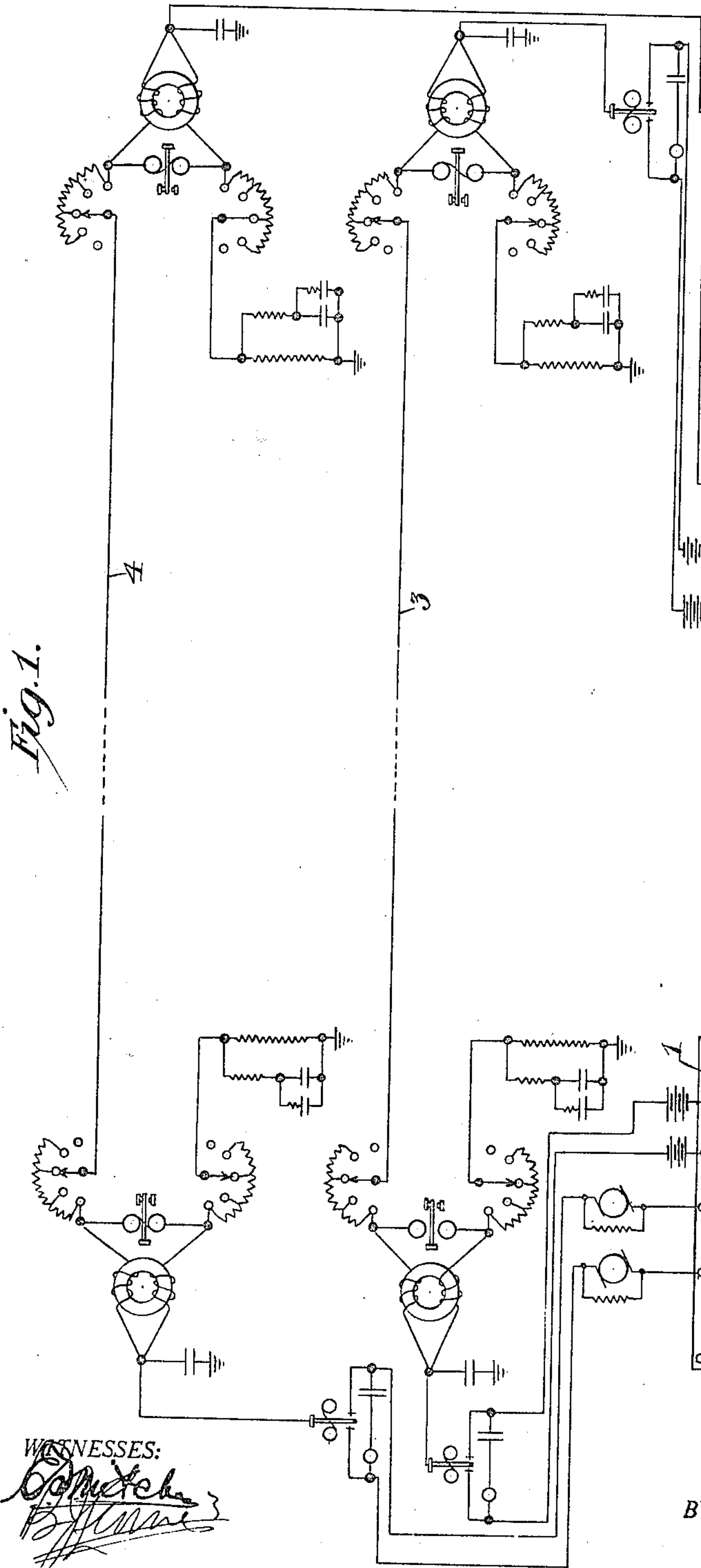


P. J. HOWE,
 MEANS FOR COMPENSATING FOR DISTURBANCES OF EARTH POTENTIAL.
 APPLICATION FILED MAR. 10, 1917.

1,254,910.

Patented Jan. 29, 1918.

Fig. 1.



WITNESSES:
[Signature]
[Signature]

Fig. 2.

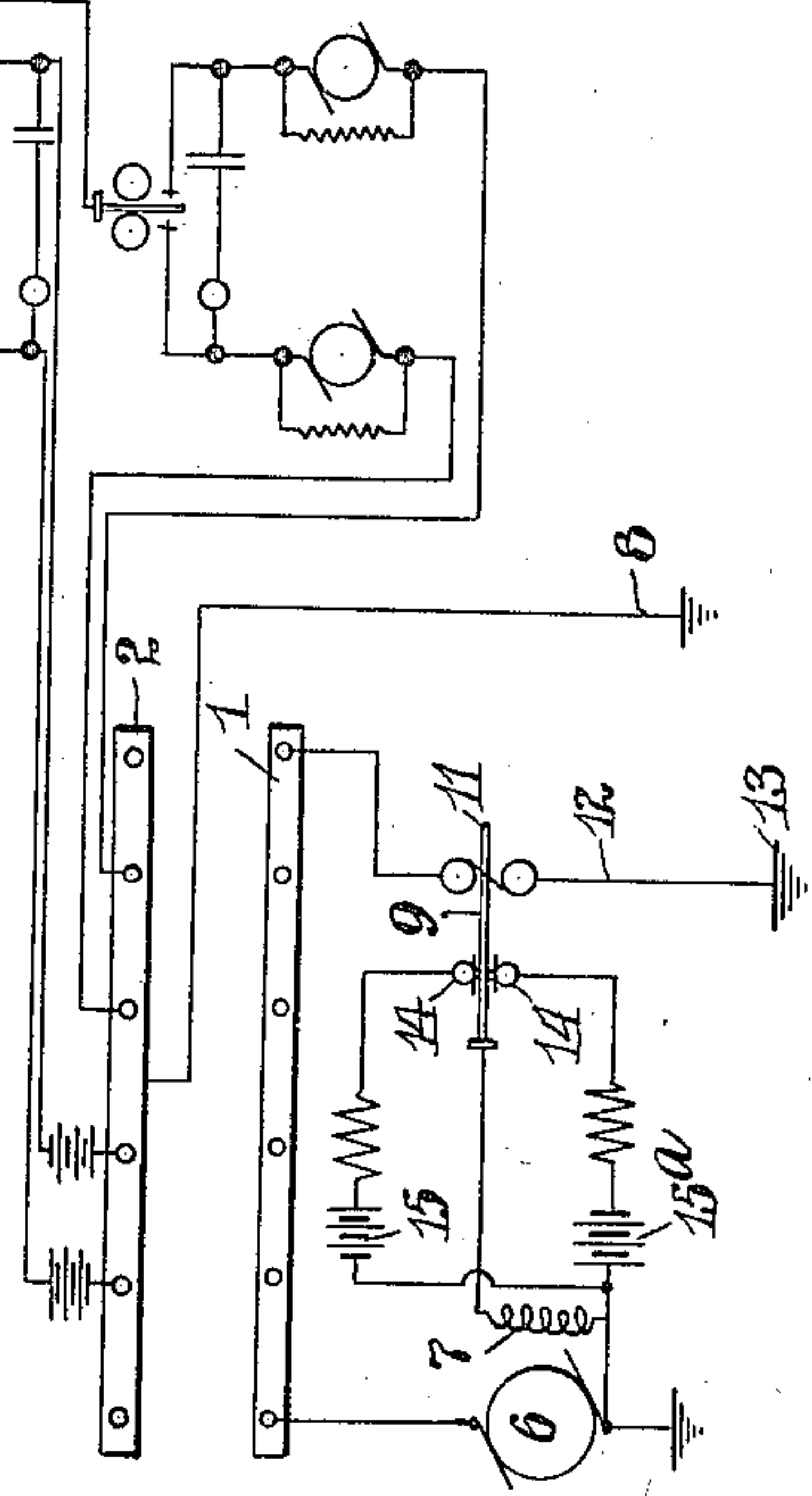
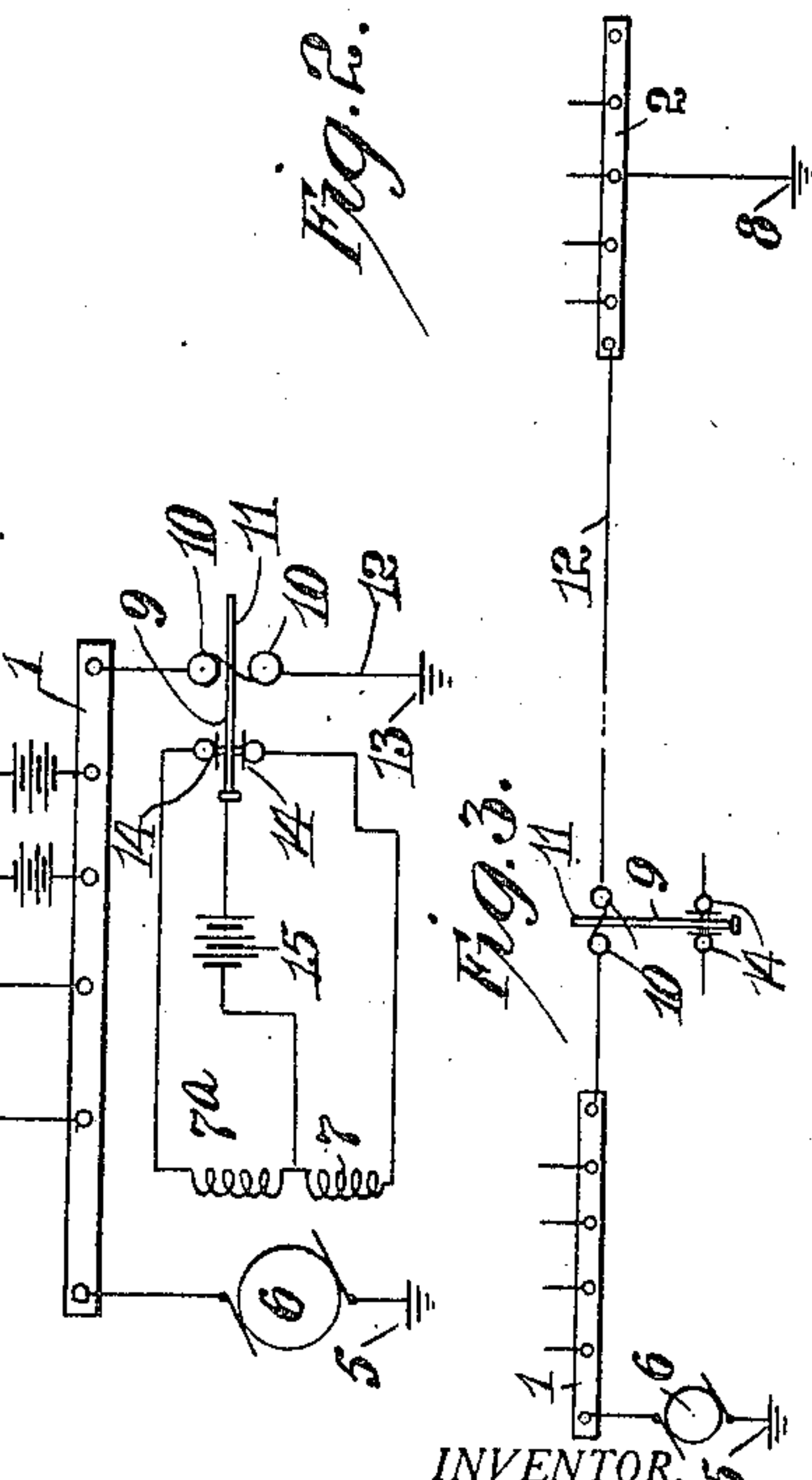


Fig. 3.



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PAUL J. HOWE, OF RIDGEWOOD, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MEANS FOR COMPENSATING FOR DISTURBANCES OF EARTH POTENTIAL.

1,254,910.

Specification of Letters Patent.

Patented Jan. 29, 1918.

Application filed March 10, 1917. Serial No. 153,830.

To all whom it may concern:

Be it known that I, PAUL J. HOWE, a citizen of the United States of America, and a resident of Ridgewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Means for Compensating for Disturbances of Earth Potential, of which the following is a specification.

This invention relates to means for compensating for differences of potential between the ground connections at the two ends of a system of electrical communication, such for example as a telegraph system, and comprises a generator located in one of the ground connections of the system, together with novel control means for that generator, and other features all as hereinafter described and particularly pointed out in the appended claims.

The object of my invention is to provide simple and reliable means for compensating for differences of potential between the grounds at the two ends of a system of communication, and to avoid any periodic oscillation of potential due to the action of the compensating means itself.

I will now proceed to describe my invention with reference to the accompanying drawings, in which Figure 1 is a diagram illustrating a compensating arrangement embodying my invention, in connection with systems of communication extending between the points between which the differences of potential exist; and Fig. 2 is a fragmentary diagram illustrating an alternative arrangement. Fig. 3 is a fragmentary diagram illustrating a further alternative arrangement.

In the operation of telegraph systems, telephone systems and the like, much trouble is frequently experienced due to a difference of potential between the grounding points of the system, which difference of potential is commonly due to neighboring electric railways or electric power circuits or the like. This difference of potential, due to causes external to the system of communication, is frequently variable, which makes correction for such difference of potential by ordinary means, yet more difficult. By the present invention such difficulty is overcome.

In the accompanying drawings, 1 and 2 designate grounding bus-bars at the two

points between which the difference of earth potential exists; and 3 and 4 designate the line wires of systems of communication extending from the one bus-bar to the other. At the ends of these conductors 3 and 4 I have shown, diagrammatically, the transmitting and receiving arrangements of ordinary duplex telegraph systems, such transmitting and receiving arrangements being too well known to require description here. The systems of communication of wires 3 and 4 are entirely separate and distinct, and there may be as many of these systems between bus-bars 1 and 2, as desired; nor need these systems of communication be of the same nature; that is to say, one might be a telegraph system and the other or others telephone systems.

5 designates an earth connection for bus-bar 1, and 6 designates a generator interposed in that ground connection, 7 and 7^a being the field windings of that generator. 8 designates the ground connection for bus-bar 2. It will be apparent that generator 6, if properly controlled and operated, will create a potential, equal and opposite to the earth potential existing between ground connections 5 and 8, so neutralizing, or compensating for, the actual difference in earth potential between points 5 and 8.

9 designates a polar relay having magnet windings 10 located in a conductor 12 leading from bus-bar 1 to some point 13 in which no potential disturbance exists. This point 13 is usually a point located laterally with respect to conductors 3 and 4; that is to say, it is not usually a point which is either in a direct line between points 1 and 2, or a point close to the line conductors 3 and 4. This relay 9 differs from ordinary polar relays in that, instead of its armature 11 playing between contact stops, as is ordinarily the case, that armature lever operates variable resistance devices 14 of a nature analogous to, and even identical with, the ordinary telephone microphone, and these variable resistance devices are represented diagrammatically by the conventional designation for a telephone microphone. The actual movements of the armature lever 11 are, naturally, extremely small; but when the armature lever is attracted in the one direction or the other, it increases the pressure in the microphone toward which lever 11 is pulled, and correspondingly de-

creases the pressure in the other microphone, so decreasing the resistance in the one microphone and increasing the resistance in the opposite microphone. The field of the generator comprises two differentially wound coils 7 and 7^a respectively, and if equal currents pass through these two coils 7 and 7^a said two coils neutralize each other. A battery 15 or other suitable source of current supply has one pole connected between these coils 7 and 7^a, and has its other pole connected to the armature 11 of relay 9, and so to the variable resistance devices 14.

The action which results with the circuit arrangements thus described is as follows:

So long as there is no disturbance of the potential, *i. e.*, so long as there is no potential difference between bus-bar 1 and grounding point 13, there will be no current through magnet coils 10 of relay 9, and consequently there will be no current generated by correcting generator 6; for the current of battery 15 divides equally between the two microphones or variable resistance devices 14, causing field coils 7 and 7^a to neutralize each other; but should there be a difference of potential between bus-bar 1 and grounding point 13 there will be a flow of current, in the one direction or the other, as the case may be, through the magnet coils 10 of relay 9, causing said coils to move the armature lever 11, to the one side or the other, according to the direction of current flow, so increasing the conductivity of the one variable resistance device 14 and decreasing the conductivity of the other variable resistance device 14, and so causing one of the field coils 7 and 7^a to preponderate in influence over the other said field coil, thereby giving to the field a magnetization which will cause generator 6 to build up a potential of a sign and value to cause it to counterbalance the disturbance already existing.

It will be obvious that the relay 9 will follow, and will adjust the conductivity of its variable resistance devices 14 in correspondence with, each change of potential difference between bus-bar 1 and grounding point 13, thus causing generator 6 to instantly correspond in voltage and sign of the potential created by it, and counterbalance, the changing potential difference between 1 and 13.

Various circuit arrangements involving the use of the variable resistance relay 9 may be devised. In Fig. 2 I show an arrangement wherein, instead of one battery 15 and two differentially wound field coils 7 and 7^a, two opposing batteries 15 and 15^a are employed, with one field coil 7; suitable resistance being employed in series with the several batteries to adjust the current strengths. It will be obvious that, as the relay 9 operates, the current of one battery will be caused to preponderate over the cur-

rent of the other battery, and therefore the current through the field coil 7 will be in the one direction or the other, according to the direction in which the armature 11 of relay 9 is attracted, the strength of the current so flowing through the field coil 7 depending upon the strength of the current in circuit 12 tending to move the armature 11 in the one direction or the other. As illustrated in Fig. 3, the conductor 12, in which the relay 9 is located, is not necessarily a conductor leading to a point external to the system and free from potential disturbance; but may be a conductor connecting the two bus-bars 1 and 2 of the system.

The means herein described for compensating for potential disturbance is not confined to compensating for direct current potential disturbance, but is also applicable for correction for either alternating current ground potential disturbance, or for alternating current electromagnetic induction. In a companion application by Joseph W. Milnor, Serial No. 153,825, Mr. Milnor has illustrated and described means for correction for alternating current disturbances such as referred to, comprising one or more correcting alternating current generators arranged to oppose the influence of other potential in the line to the disturbing potential, and comprising a control wire, corresponding substantially to the conductor 12, of the present application, current through which control wire, due to uncorrected or over-corrected alternating current disturbance, operates relay means whereby the correcting generator or generators is or are controlled to effect proper correction. The particular control means herein illustrated and described is adapted to be substituted in the arrangements of the said Milnor application, for the control relays and associated means of that Milnor application, and the relations of the two applications is such that this substitution is of an obvious nature.

What I claim is:

1. Means for compensating for potential disturbance in systems of communication comprising a generator connected in the system of communication to oppose a counteracting potential to the disturbing potential, a conductor exposed to the disturbing influence of the disturbing potential, a polar relay interposed in such conductor and comprising variable resistance means arranged to be operated by such relay, and means operated by such variable resistance means whereby, as said relay is operated in one direction or another by a disturbing potential, the field of the generator is excited in the one sense or the other to produce a counteracting voltage.

2. Means for compensating for potential disturbance in systems of communication comprising a generator connected in the

system of communication to oppose a counteracting potential to the disturbing potential, a polar relay comprising variable resistance means arranged to be operated by such relay, means operated by such resistance means whereby, as said relay is operated in one direction or another, the field of the generator is excited in the one sense or the other, and means for the control of said relay by the disturbing potential.

3. Means for compensating for potential disturbance in systems of communication comprising a generator connected in the system of communication to oppose a counteracting potential to the disturbing potential, a polar relay comprising variable resistance means arranged to be operated by such relay means operated by such resistance means whereby, as said relay is operated in one direction or another, the field of the generator is excited in the one sense or the other, and a circuit through the controlling magnet of said relay, through which current, due to the potential disturbance, passes.

4. A ground connection for systems of communication comprising a connection from one point of such system to a grounding point at which disturbance of earth potential may exist, a generator in such connection having a controlling field coil, a conductor, other than the main conductor or conductors of such system or systems of communication, through which current, due to the disturbance of earth potential, will flow, a polar relay having a controlling magnet interposed in said conductor, and having variable resistance means arranged to be operated by such relay, when that relay is operated by current flowing through such

conductor, and means operated by such resistance means whereby, as the relay is operated in one direction or another, the field of the generator is excited in the one sense or the other.

5. A ground connection for systems of communication comprising a connection from one point of such system to a grounding point at which disturbance of earth potential may exist, a generator in such connection having two opposing field coils, a conductor, other than the main conductor or conductors of such system or systems of communication, through which current, due to the disturbance of earth potential, will flow, a polar relay having a controlling magnet interposed in said conductor, and having two variable resistance means operated in opposite senses, relatively, by movements of the armature of said relay, each of said variable resistance means being in circuit with one of the two opposing field coils of said generator, and a source of current supply connected to both of said field coils and to said variable resistance means, whereby, when said variable resistance means are of equal resistance, the said field coils neutralize one another, and whereby, as the resistance of one variable resistance means is increased and the resistance of the other variable resistance means is decreased by the action of said relay, the one field coil or the other is caused to predominate.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

PAUL J. HOWE.

Witnesses:

H. M. MARBLE,

PAUL H. FRANKE.