

April 20, 1926.

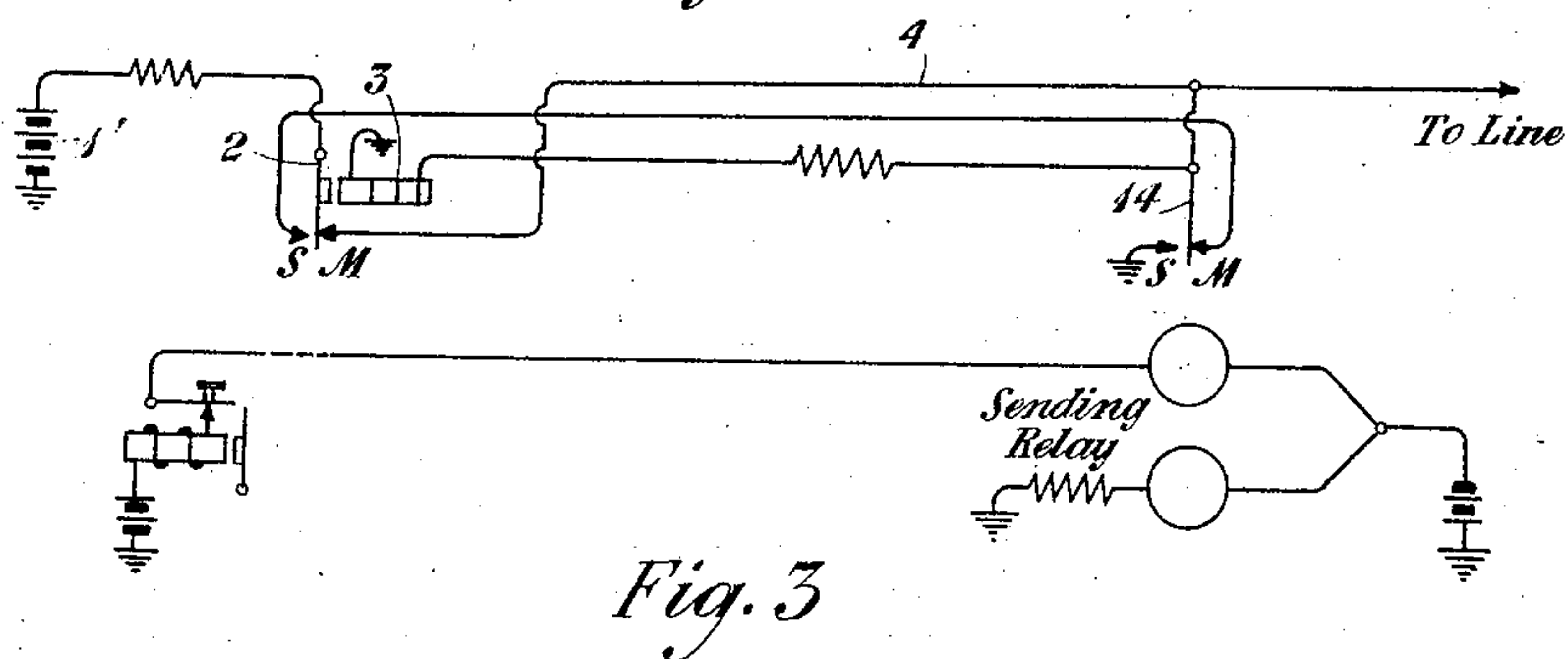
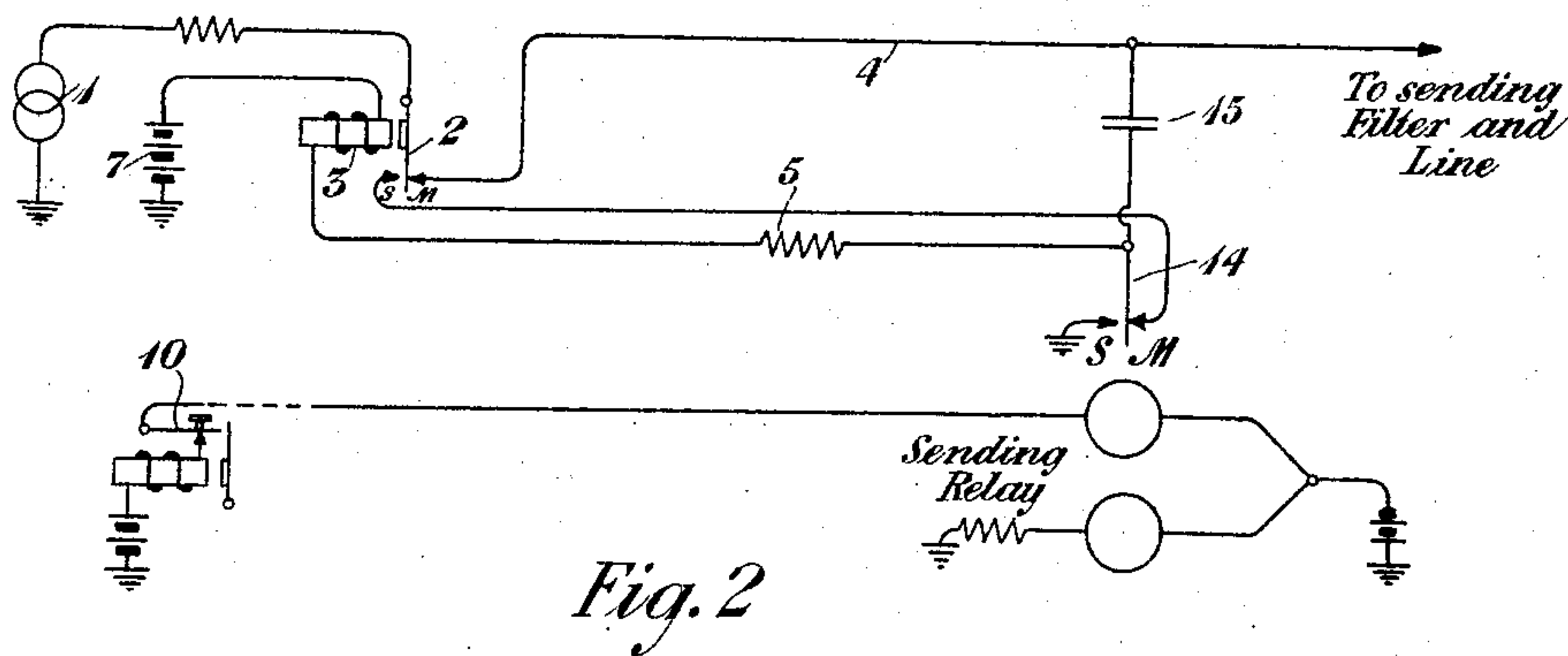
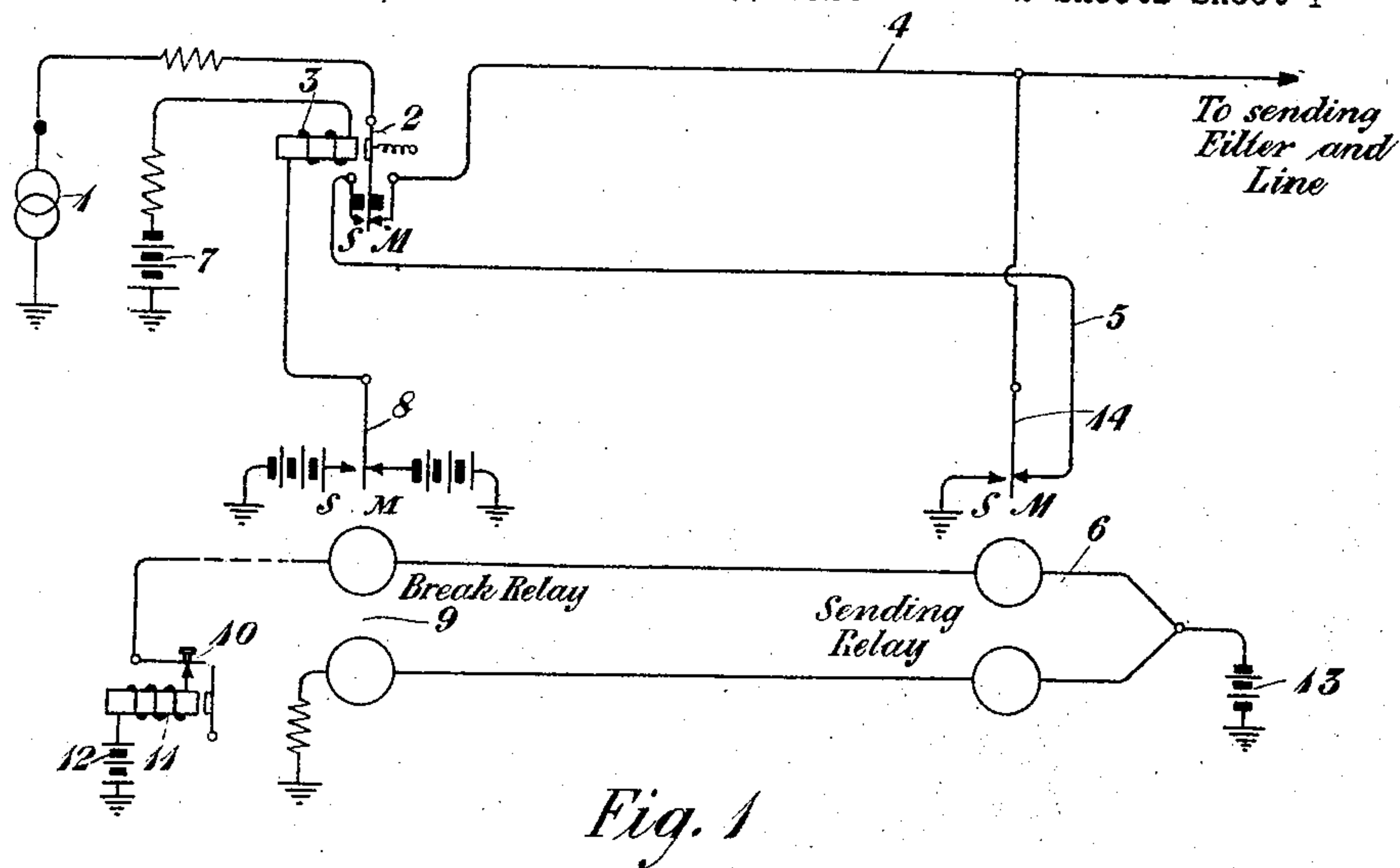
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1,581,326

MEANS FOR PREVENTING BIAS IN TELEGRAPH SYSTEMS

Filed March 29, 1924

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

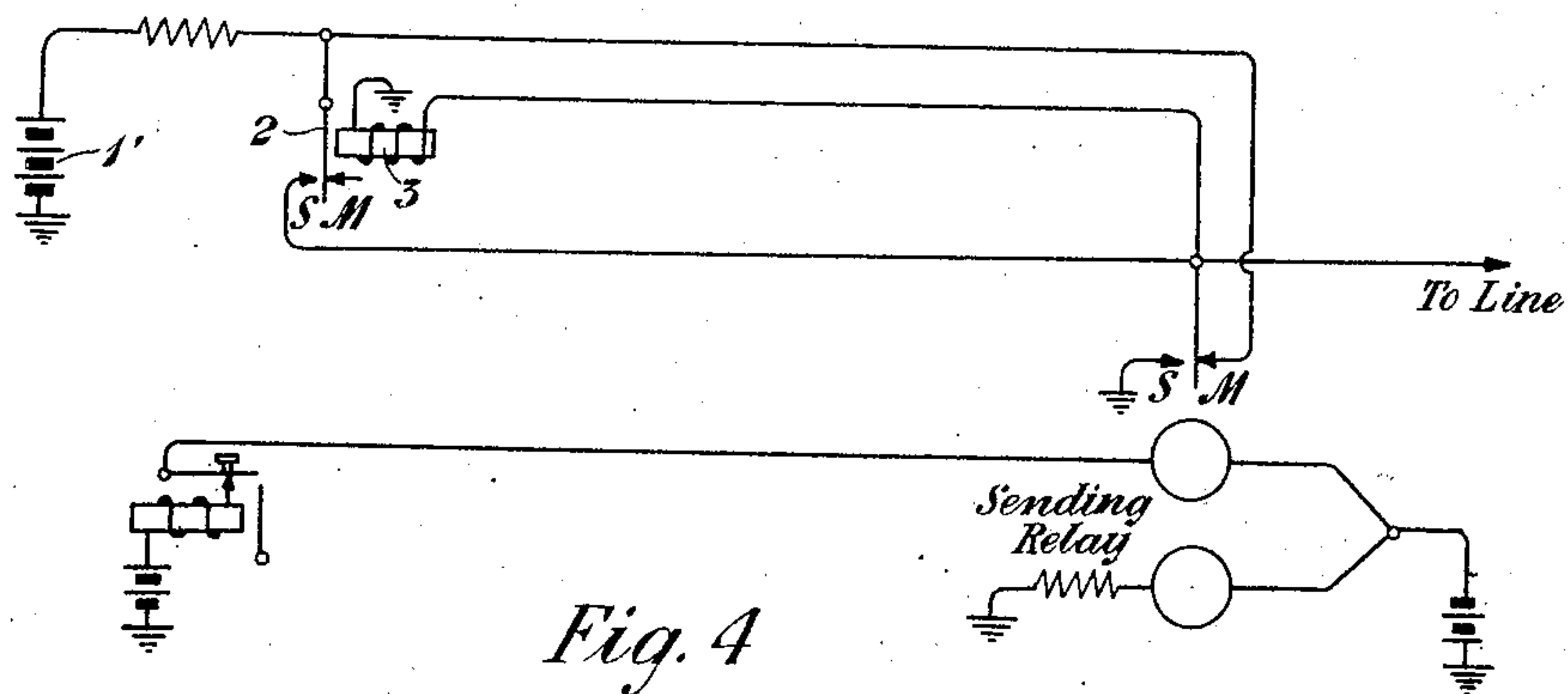


Fig. 4

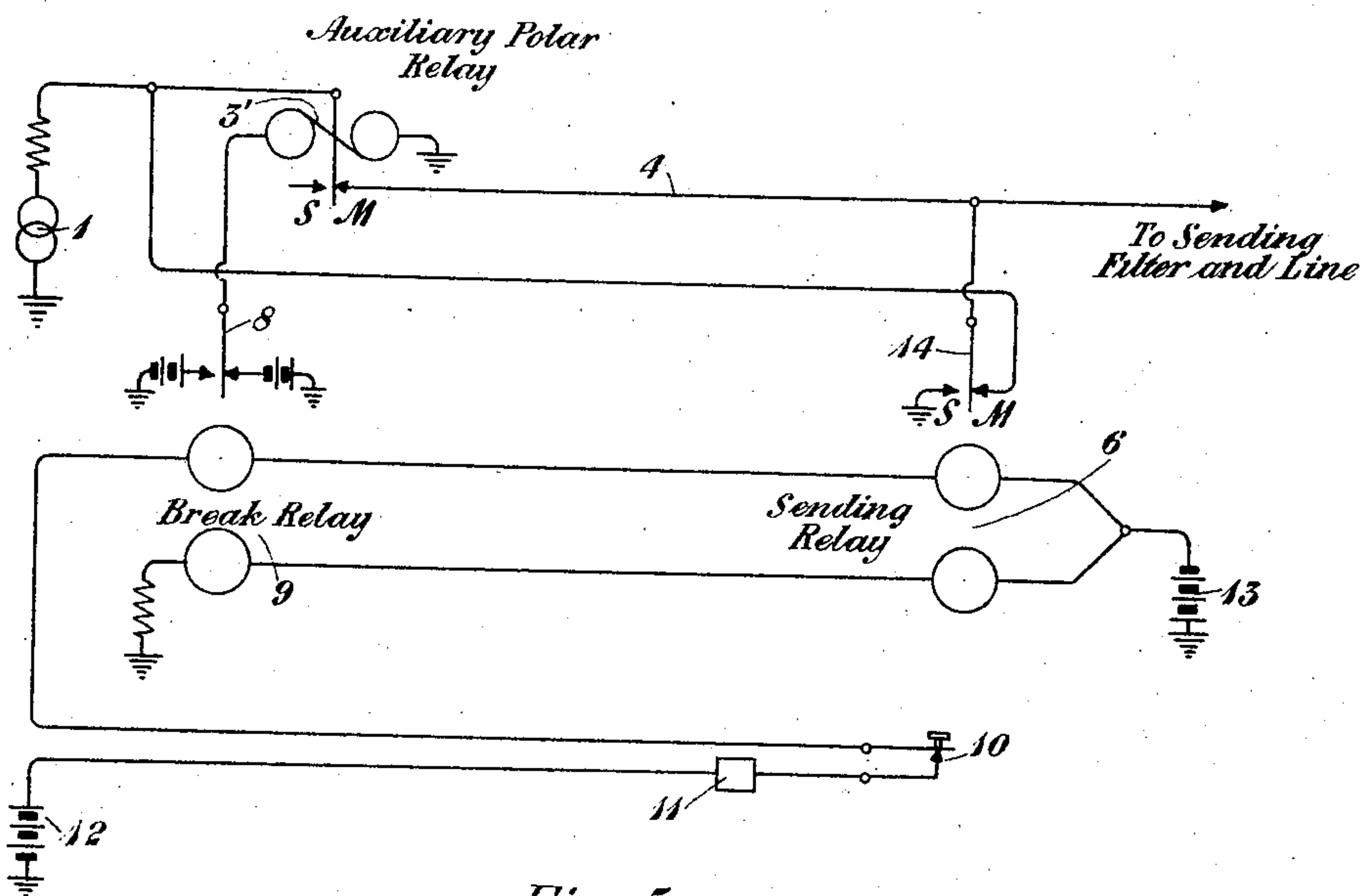


Fig 5

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UNITED STATES PATENT OFFICE.

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MEANS FOR PREVENTING BIAS IN TELEGRAPH SYSTEMS.

Application filed March 29, 1924. Serial No. 702,876.

To all whom it may concern:

Be it known that I, ROY B. SHANCK, a citizen of the United States, residing at Elmhurst, in the county of Queens and State of New York, have invented certain Improvements in Means for Preventing Bias in Telegraph Systems, of which the following is a specification.

This invention relates to telegraph signaling systems and particularly to means for preventing the introduction of bias into telegraph signals, due to the effect of the travel time of the armatures of the relays of the telegraph system.

In telegraph systems, particularly of the carrier type, difficulty has been experienced due to the lengthening of the marking impulses of such signals, which was caused by the time consumed by the armature of the relays in traveling between contacts. It is the object of this invention to eliminate this source of bias of such signals. This invention will be understood from the following description when read in connection with the attached drawing, of which Figures 1, 2 and 5 are embodiments of the invention in a carrier telegraph system, and Figs. 3 and 4 relate to direct current systems.

In Fig. 1, a source of carrier current 1 is connected with the armature 2 of the relay 3, which will be referred to hereinafter as the auxiliary relay. This relay is preferably of the "make before break" type. The marking contact of this relay is connected with the conductor 4 which, as indicated, is connected with the sending filter and in turn with the line, as in any well known carrier telegraph system. The spacing contact of relay 3 is connected by conductor 5 with the marking contact of the sending relay 6. The spacing contact of this relay is grounded. One terminal of the winding of the auxiliary relay 3 is connected with the negative battery 7, and the other terminal is connected with the armature 8 of the break relay 9, which is connected with the subscriber's loop circuit. The armature 8 is adapted to move between marking and spacing contacts, which are connected with negative and positive batteries respectively. The loop circuit may be of any well known type, comprising a key 10 and a sounder 11, and having oppositely poled batteries 12 and 13 connected therewith.

The nature of this invention will probably

be made clearer by describing the system heretofore used. Let it be assumed that the generator 1 is connected directly with the conductor 4 and that the auxiliary relay has been removed therefrom. When the subscriber's key 10 of such system is closed for the transmission of a marking signal, the armature 14 of sending relay 6 will begin to move from its grounded spacing contact to its marking contact. As long as this armature remains upon its spacing contact, the generator 1 is connected therethrough to ground, so that the waves of signaling frequency do not pass to the sending filter or to the line. However, as soon as the armature 14 leaves the spacing contact and moves toward its marking contact, this shunt path to ground is removed and the transmission of the marking impulse begins, and it continues as long as the armature 14 remains upon its marking contact and until it returns again to its spacing contact. It will be apparent, therefore, that when a mark of a given length of time is transmitted from the subscriber's station an impulse of carrier frequency current will be impressed upon the line by the source 1 from the time the armature 14 leaves the spacing contact until it returns thereto. This results in lengthening the carrier frequency impulse representing the marking signal by an amount equal to the time required for the armature to travel once from one contact to the other. In order to avoid this biasing effect, the auxiliary relay 3 has been added in the manner shown in Fig. 1 so that in commencing a marking signal a carrier current will not be impressed upon the line until the armature has traveled from the spacing to the marking contact and has touched the latter. Since carrier current is not cut off from the line at the beginning of a space until the armature travels from the marking to the spacing contact, it will be clear that both the beginning and the end of a marking impulse will be delayed by an amount equal to the travel time but that there will be no resultant bias, providing the travel times in the two directions are equal. It is believed that, in general, they are substantially equal.

The manner in which the system involving the auxiliary relay functions to prevent the bias described above is as follows: The auxiliary relay 3 is controlled by the operation of the break relay 9, having

positive and negative batteries connected to its contacts. When the subscriber opens his key 10 for the transmission of a spacing impulse the armatures 14 and 8 of the sending and of the break relays respectively will travel from their marking to their spacing contacts. When the armature of the sending relay 6 reaches its spacing contact the transmission of the carrier current to the line will be stopped by the shunting of the line circuit through the spacing contact of relay 6. An instant later the auxiliary relay 3 will operate because it is energized by current flowing from the spacing contact of relay 9 through its armature 8 and the winding of relay 3 to battery 7. The armature 2 of auxiliary relay 3 thereupon disconnects the source 1 of carrier current from conductor 4 and connects this source through the spacing contact of relay 3 to conductor 5, which is connected with the marking contact of relay 6. This is the condition existing at the termination of the sending of the spacing signal from the subscriber's station. When the key 10 is closed to transmit a marking signal the armatures 8 and 14 begin to leave their spacing contacts and move toward their marking contacts, but the carrier current does not begin to flow to the line as in the older system described above because in the present system the source 1 is now connected through the armature 2 with conductor 5 and the marking contact of relay 6, and is disconnected from conductor 4. The carrier current will not be applied to the line until the armature 14 reaches the marking contact. An instant later, that is, as soon as the armature 8 reaches its marking contact, relay 3 is deenergized and its armature 2 moves to its marking contact. Conditions are thus again established for commencing the next spacing signal. As stated above, the auxiliary relay 3 is of the make before break type so that the carrier current will not be interrupted while the auxiliary relay is switching the source 1 from its spacing to its marking contact.

The arrangement shown in Fig. 2 differs from that shown in Fig. 1 in that the auxiliary relay is controlled by the sending relay instead of by the break relay. In Fig. 2 a condenser 15 of fairly large capacity is inserted in the connection between the armature 14 and conductor 4 in order to prevent direct current from the source 7 flowing to the line. The manner in which this circuit operates is as follows: Assume that the armature 14 is upon its spacing contact and that a marking signal is transmitted from the subscriber's station by closing key 10. While the armature 14 is upon its spacing contact, relay 3 will be energized by a flow of current from battery 7, through the winding of said relay, and through the spacing contact of relay 6 to ground. The armature

2 of relay 3 will be drawn against its spacing contact and will connect the source 1 of the carrier current with conductor 5, connected with the marking contact of the sending relay. The situation, therefore, is such that carrier current from the source 1 will not be applied to the line when the armature 14 leaves its spacing contact, and not until the said armature reaches its marking contact. As soon as the armature 14 moves away from its spacing contact, relay 3 will be released and its armature, too, will move toward its marking contact, but since this relay is preferably slower-acting and of the make-before-break type it will not leave its spacing contact until after the armature 14 has closed its marking contact. Under these conditions the carrier current impulse will begin to be applied to the line as soon as the armature 14 reaches its marking contact and will continue to be applied so long as it remains thereon. When the subscriber transmits a spacing signal, the armature 14 will move from its marking to its spacing contact, but the carrier frequency impulse will continue to be applied through conductor 4 to the line as long as the armature 2 remains upon its marking contact, which will be until the armature 14 reaches its grounded spacing contact. As in the arrangement shown in Fig. 1, it will be seen that if the travel times are equal the marking and the spacing signals will be prolonged by equal amounts, that is to say, by the time necessary for the armature 14 to pass from one contact to the other.

The arrangements shown in Figs. 3 and 4 illustrate the application of the invention to direct current telegraph systems. Fig. 3 shows the application to a telegraph system in which the spacing signals are transmitted by short-circuiting the source of current, and Fig. 4 illustrates the application to a system of the open and close type with battery at one end only. In the latter, a space is commenced as soon as the sending relay armature leaves the marking contact and is terminated as soon as the armature leaves the spacing contact. The mode of operation of these circuits will be obvious in view of the descriptions of Figs. 1 and 2, and for that reason it is believed that they need not be described in detail. In the arrangement shown in Figs. 3 and 4 the auxiliary relay 3 in each case must be adjusted so as to respond to current which flows through it when the sending relay is in the marking position. It is, furthermore, desirable to have the auxiliary relay slow-acting to the extent that it will operate an instant after the completion of the travel of the armature of the sending relay 6, and preferably of the make-before-break type.

The arrangement shown in Fig. 5 differs structurally from that shown in Fig. 1 by

using an auxiliary relay of the polar type in place of the non-polar relay 3 of Fig. 1. This relay should be quick-acting and not of the make-before-break type. With the armatures in the position shown in the figure, carrier current from the source 1 will be applied to the line through the marking contact of auxiliary relay 3' and also through the marking contact of the sending relay 6. When the key 10 at the subscriber's station is opened for the transmission of a spacing impulse, the armatures 14 and 8 will begin to move toward their spacing contacts. The armature of relay 3' will, however, not open its marking contact until the armature 8 of the break relay touches its spacing contact, that is to say, until an impulse of current from the positive battery is transmitted through the windings of the polar relay. In like manner, when the key 10 is closed for the transmission of a marking signal the armatures 8 and 14 will begin to travel from their spacing to their marking contacts. The armature of relay 3' will, however, remain upon its spacing contact until the armature 8 has reached its marking contact and has transmitted through the winding of 3' an impulse of the required polarity to move its armature to its marking contact. However, the marking signal will begin to be applied to the line as soon as the armature 14 comes in contact with its marking contact which is connected directly with the generator 1.

It will be seen that by means of the afore-described arrangements, the biasing of the signals, which was an inherent defect in the systems of the prior art, may be prevented. It will, furthermore, be seen that the invention is not limited to carrier current telegraph systems but is applicable to direct current systems of different types.

While this invention has been disclosed as embodied in a particular form and arrangement of parts it is to be understood that it is not so limited but is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a system for minimizing bias of telegraph signals, the combination with a source of potential of a line normally effectively connected with the said source, a sending relay adapted to shunt the said line for the transmission of a spacing signal, a break relay, means to control the said sending and the said break relays, and an auxiliary relay controlled by the said break relay to equalize the effect of the armature travel time of the sending relay on the marking and the spacing impulses.

2. In a system for minimizing bias of telegraph signals, the combination with a source of carrier voltage of a line to which the said voltage is applied for the transmission of a marking impulse, switching means to effectively shunt the said line for the transmission of a spacing impulse, means to control the operation of the said switching means, and a second switching means controlled by the same controlling means as the said first switching means to equalize the length of the marking and the spacing impulses as applied to the said line.

3. In a system for minimizing bias of telegraph signals, the combination with a source of potential of a line to which such potential is applied for the transmission of a marking impulse, switching means to shunt the said line to transmit a spacing impulse, and means to equalize the duration of the marking and the spacing periods.

4. In a system for minimizing bias of telegraph signals, the combination with a source of potential of a line to which such potential is adapted to be applied, switching means arranged to shunt the said line whenever a spacing impulse is to be transmitted, and means to equalize the duration of the marking and spacing periods of the said switching means.

5. In a system for minimizing bias of telegraph signals, the combination with a source of potential of a line to which such potential is normally applied for the transmission of a marking signal, a relay whose armature shunts the said line for the transmission of a spacing impulse, and means to prevent the application of the said potential to the said line after a spacing impulse has been transmitted until the armature subsequently touches its marking contact.

6. In a system for minimizing bias of telegraph signals, the combination with a line of a source of alternating potential, an auxiliary relay having its armature connected with the said source and its make contact connected with the said line, a break relay having its armature connected with the winding of the auxiliary relay and having its contacts connected with sources of potential of opposite polarity, a sending relay having its armature connected with the said line, its spacing contact to ground and its make contact with the spacing contact of the auxiliary relay, and a loop circuit having connected therewith a source of potential and a key to control the said sending relay and the said break relay.

In testimony whereof, I have signed my name to this specification this 24th day of March, 1924.

ROY B. SHANCK.