

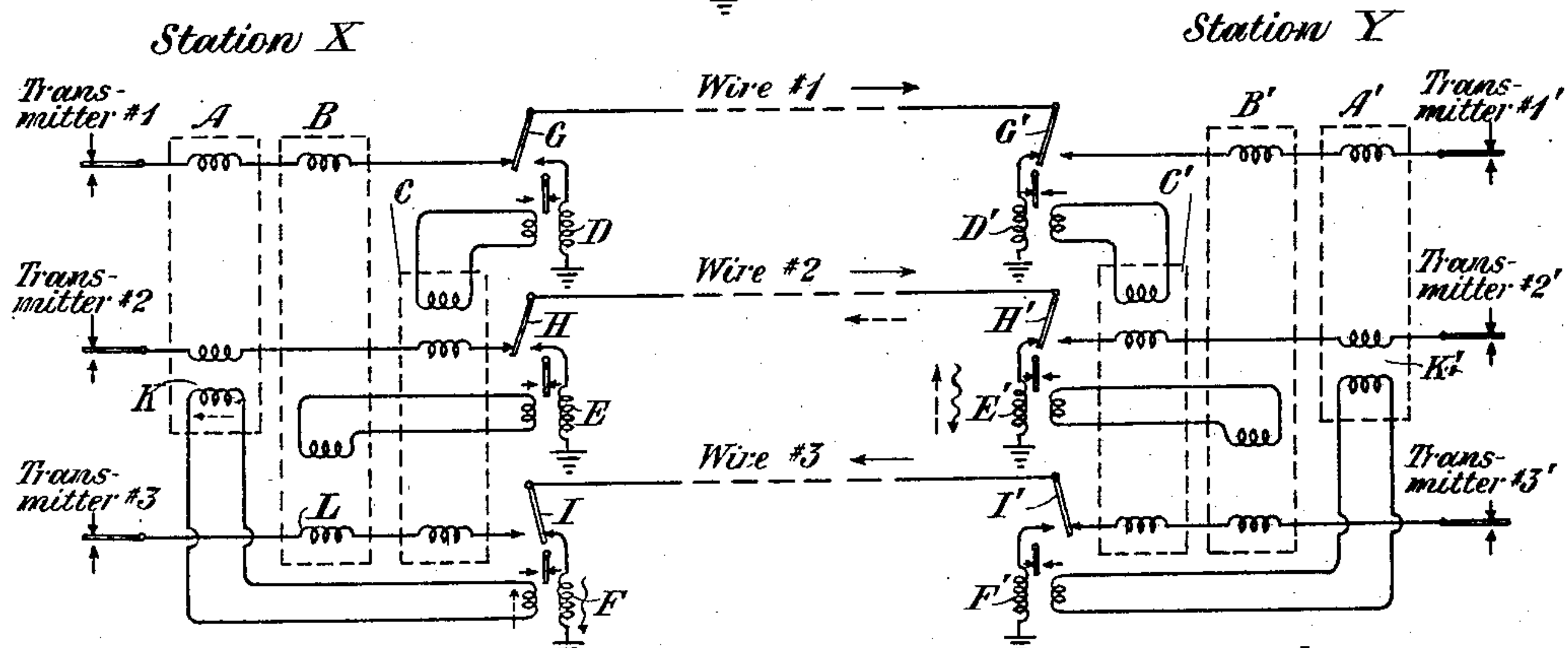
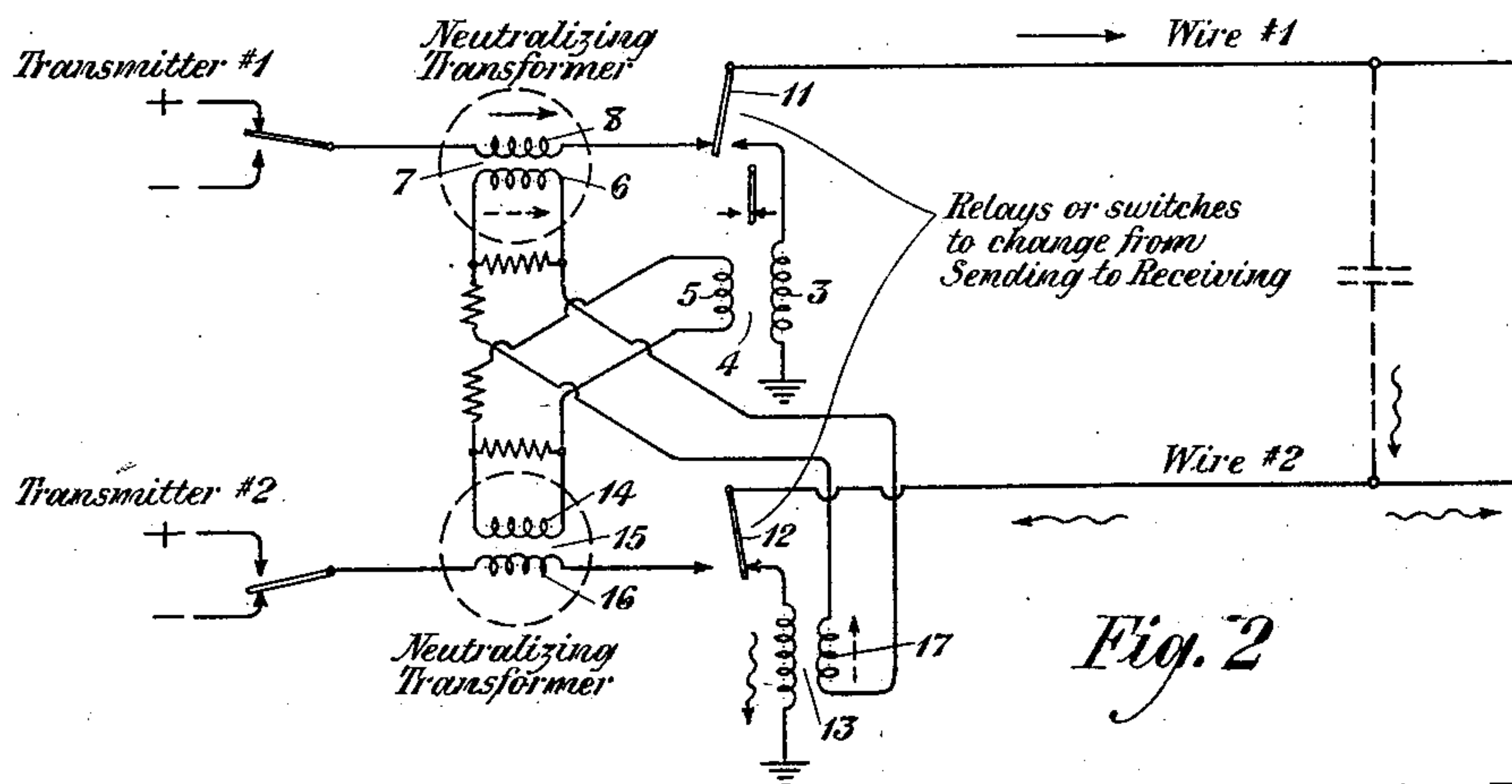
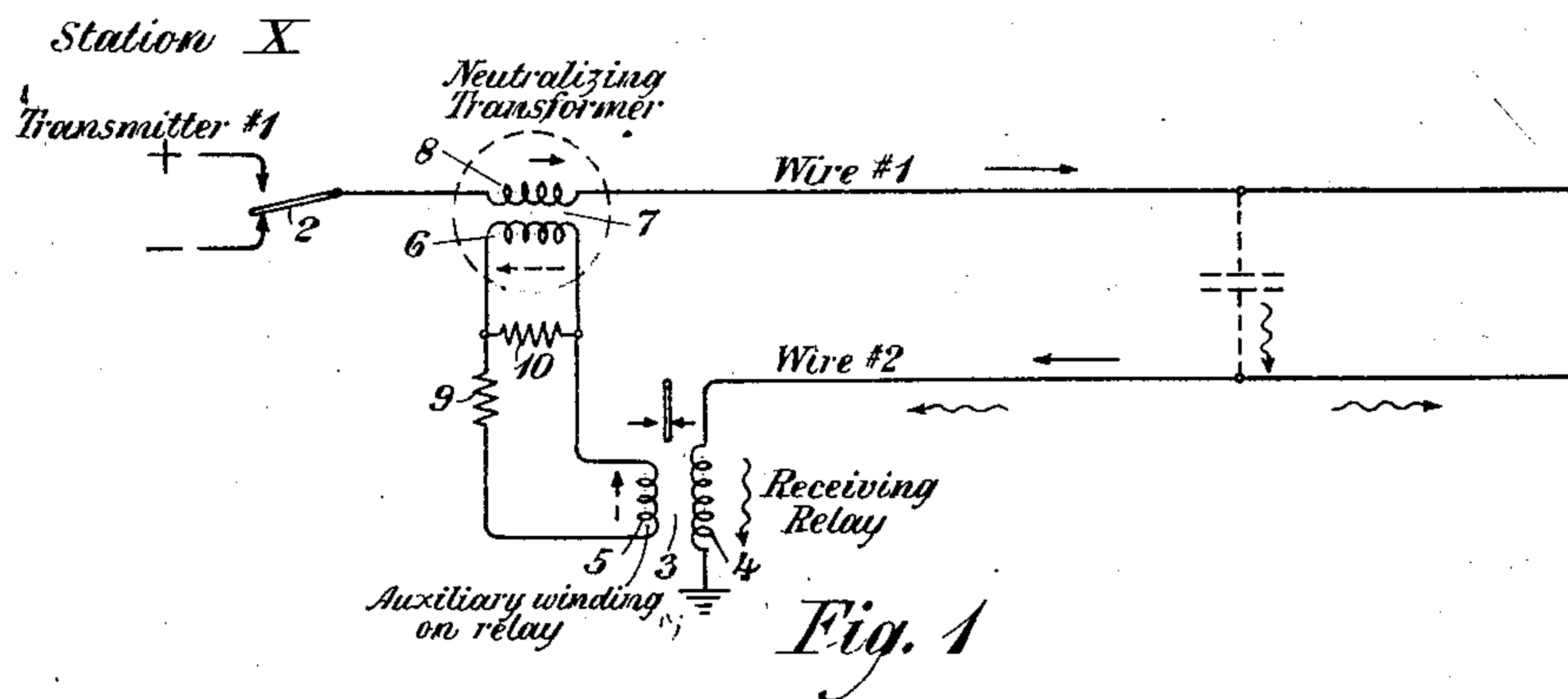
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CROSS FIRE NEUTRALIZING SYSTEM

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CROSS-FIRE-NEUTRALIZING SYSTEM.

Application filed September 18, 1924. Serial No. 738,503.

This invention relates to telegraph circuits, and particularly to means for neutralizing cross-fire between adjacent circuits.

When telegraph impulses are transmitted over one of a plurality of circuits constituting a telegraph system, disturbing currents known as cross-fire are set up in the other circuits of the system due to the admittance between the various circuits. Various means have been suggested to neutralize the cross-fire currents. Some of these arrangements are intended to neutralize sending end cross-fire, that is, the cross-fire set up in the receiving instruments of the exposed circuits, which instruments are located at the same end of the telegraph system from which the disturbing signals are being transmitted. Other arrangements are designed to care for receiving end cross-fire, that is, the currents set up in the receiving instruments of the disturbed circuits located at the distant end of the system. One form of neutralizing arrangement is disclosed in the co-pending patent to Cory, No. 1,560,540, which issued Nov. 10, 1925, in which the different transmitter circuits are coupled together so that, when a signal impulse is transmitted over one of them, a neutralizing impulse will be applied to the other which will neutralize the receiving end cross-fire as defined above.

It is the object of the present invention to neutralize cross-fire between non-duplex polar telegraph circuits. By this term is meant a circuit over which transmission can take place in only one direction at one time and which employs current reversals to represent marks and spaces. Such a circuit resembles the single line Morse circuit in that transmission takes place in only one direction at any time, but it differs from the latter circuit in that signals are transmitted by reversing the polarity of the battery applied to the line, rather than by opening and closing the line, and this, as is well known, affords better transmission.

The invention will be clearly understood from the following description, when read in connection with the attached drawing, of which Figure 1 shows the embodiment of the invention in a communication circuit employing two one-way polar circuits; Fig. 2 shows the embodiment of the invention in a system comprising two communication

circuits each consisting of a two-way non-duplex polar circuit; and Fig. 3 shows the embodiment of the invention in a communication system comprising more than two two-way non-duplex polar circuits.

In the arrangement shown in Fig. 1, the tongue 2 of the transmitter #1 is connected with the wire #1 which extends to the distant receiving station and terminates there in a polar receiving relay similar to 3, which is connected with wire #2. Likewise, at the distant station, wire #2 is connected with a transmitter similar to #1 at station X. The receiving relay 3 may be of any well-known polar type having its main winding 4 connected with the wire over which the signaling impulses are transmitted from the distant station. This receiving relay also has an auxiliary winding 5 which is connected with the winding 6 of the transformer 7, another winding of which, designated 8, is connected between the tongue of the transmitter #1 and wire #1. Each of the wires, together with its associated transmitter and polar receiving relay, constitutes a one-way polar circuit, and the combination of two such circuits constitutes a complete two-way signaling circuit.

When signaling impulses are sent over wire #1 from the transmitter #1 to the distant station, for example, in the direction represented by the solid arrow, the interfering current known as cross-fire will be set up in wire #2 by virtue of the mutual admittance between the two circuits, which is symbolically represented by the dotted condenser connected between the circuits as shown dotted. This cross-fire current represented by the wavy arrows will flow in both directions in wire #2 to ground. That which flows toward the transmitter connected with wire #2 at the distant end thereof will produce no detrimental effect. On the other hand, the cross-fire current that flows through receiving relay 3 tends to interfere with the reception of signals at station X. By coupling the transmitter circuit of wire #1 with the receiving relay of wire #2, this is prevented in the following manner: When the signal impulse passes through the winding 8 of transformer 7, a neutralizing impulse will be set up in winding 6 in the direction represented by the dotted arrow, which flows through the auxil-

ary winding 5 of the receiving relay and serves to neutralize the effect of the cross-fire current therein. The magnitude of this current may be controlled by the looseness or tightness of the coupling of the various windings and also by the series and shunt resistances 9 and 10 connected in the neutralizing circuit.

The arrangement shown in Fig. 2 illustrates the application of this principle to two two-way non-duplex circuits. In this arrangement, each wire serves not only to transmit from station X to the distant station but also to transmit from the distant station to station X. The proper connection of the wire with the transmitter and the receiving polar relay is effected by means of the switches 11 and 12 which may be either manually operated or controlled automatically by means of the transmitters. The manner of doing this forms no part of this invention and for the sake of simplicity they will be represented simply as manually operated switches. With the switches thrown in the directions shown in the figure, the transmitter #1 is connected with wire #1 to transmit to the distant station, and the receiving relay 13 is connected with wire #2 for receiving signals from the distant station. Each of the receiving relays has an auxiliary winding connected with a winding of a neutralizing transformer, the other winding of which is connected with the transmitter circuit of the other non-duplex polar circuit. Thus the auxiliary winding 5 of the polar relay connected with wire #1 is connected with the winding 14 of the neutralizing transformer 15, the primary winding 16 of which is connected with the transmitter of wire #2. In like manner, the auxiliary winding 17 of the relay 13 is connected with the secondary winding 6 of the neutralizing transformer 7 of the other transmitter circuit.

When a signal is being transmitted from transmitter #1 over wire #1 to the distant station in the direction represented by the solid arrow, the cross-fire currents will be set up in wire #2 in the directions represented by the wavy arrows. Since signals are being received from wire #2 by the polar relay 13, we need consider only the cross-fire current that flows therethrough. Whenever such cross-fire current flows, there will at the same instant flow through the winding 17 a neutralizing current represented by the dotted arrow, which will be created by the signal impulse flowing through the primary winding of transformer 7.

When switches 11 and 12 are arranged for sending on wire #2 and receiving on wire #1, neutralization of sending end cross-fire from wire #2 to wire #1 is effected by the transformer 15 and winding 5 of relay 4, in a manner similar to that just described.

The arrangement of Fig. 3 shows the application of the invention to a system consisting of more than two two-way non-duplex polar circuits. Specifically, three circuits are shown which require three transformers at each end thereof, those at station X being designated A, B and C and those at station Y A', B' and C'. With the switches G, H and I and G', H' and I' in the positions shown in the drawing, the circuits are arranged for transmission over wires #1 and #2 from left to right and over wire #3 from right to left. The directions of the signal impulses are represented by the solid arrows. The flow of signaling current over wire #1 will produce cross-fire in relay E' and relay F. The cross-fire effect in relay F is neutralized by the neutralizing current, represented by the dotted line, set up in the auxiliary winding of the relay by the potential induced in winding K of transformer A. In relay E' the cross-fire is neutralized by the neutralizing current, shown by the dotted arrow, produced in wire #2 and flowing through the line winding of the relay due to the potential induced in winding L of transformer B. With the arrangement shown, the transformer A will thus neutralize the sending end cross-fire over wires #1 and #2 to #3, and the receiving end cross-fire between #1 and #2. The transformer B will neutralize the sending end cross-fire from #1 and #3 to #2 and the receiving end cross-fire between #1 and #3. The transformer C will neutralize the sending end cross-fire from #2 and #3 to #1 and the receiving end cross-fire between #2 and #3. The transformers at station Y, having the same letters primed, will effect neutralization of cross-fire in a similar manner.

While this invention has been disclosed as embodied in a particular form, it is to be understood that it 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 cross-fire neutralizing system, the combination with a line having at the home station a transmitter connected thereto of a second line having at the same station as the first line a polar relay connected thereto, and an inductive coupling between said transmitter and the winding of the said polar relay to neutralize the cross-fire in the said relay resulting from the transmission of signals over the said first line.

2. In a cross-fire neutralizing system, the combination with a line having at the home station a transmitter connected thereto of a plurality of lines each having at the same station as the first line a polar relay connected thereto, and an inductive coupling between the said transmitter and the winding of each of the said polar relays to neutralize

the cross-fire in the said relays resulting from the transmission of signals over the said first line.

3. In a cross-fire neutralizing system, the combination with a plurality of lines each having at each end a transmitter and a polar relay associated therewith, of switching means to connect a line either with its transmitter or with its receiving relay, and inductive couplings between the transmitter of each line and the winding of each of the polar relays of the other lines to neutralize cross-fire in the relay of one line resulting from the transmission of signals over the said other line.

4. In a cross-fire neutralizing system, the combination with a plurality of lines each

having at each end a transmitter and a polar relay associated therewith, each relay having a main and an auxiliary winding, of switching means to connect either the said transmitter or the main winding of the relay with the line to which the said transmitter and relay are individual, and inductive couplings between the transmitter of each line and the auxiliary windings of the relays of the other lines to neutralize cross-fire in any line resulting from the transmission of signals over another line.

In testimony whereof, I have signed my name to this specification this 16th day of September, 1924.

ROY B. SHANCK.