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INTERMEDIATE TELEGRAPH SET FOR DUPLEX LINES

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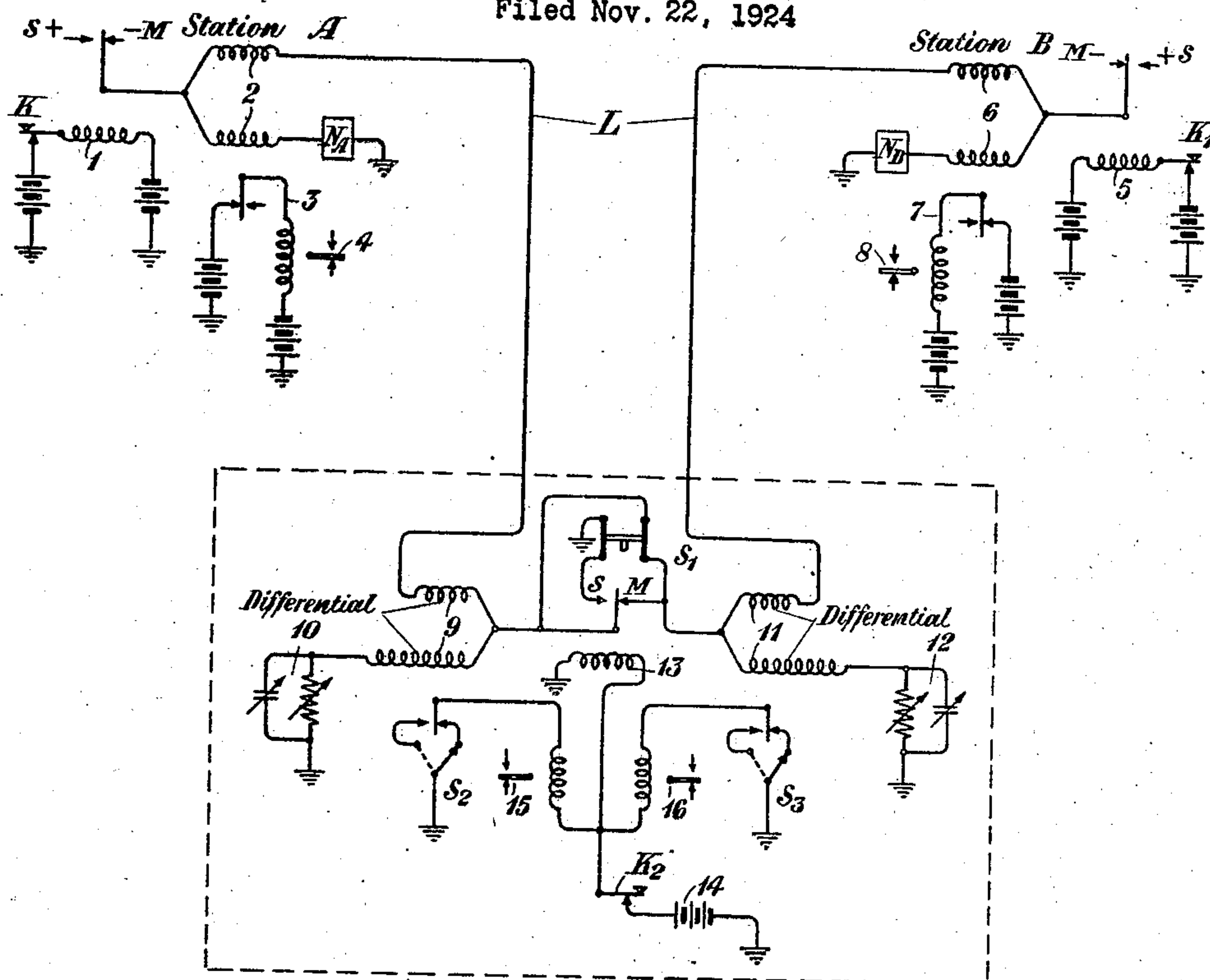


Fig. 1

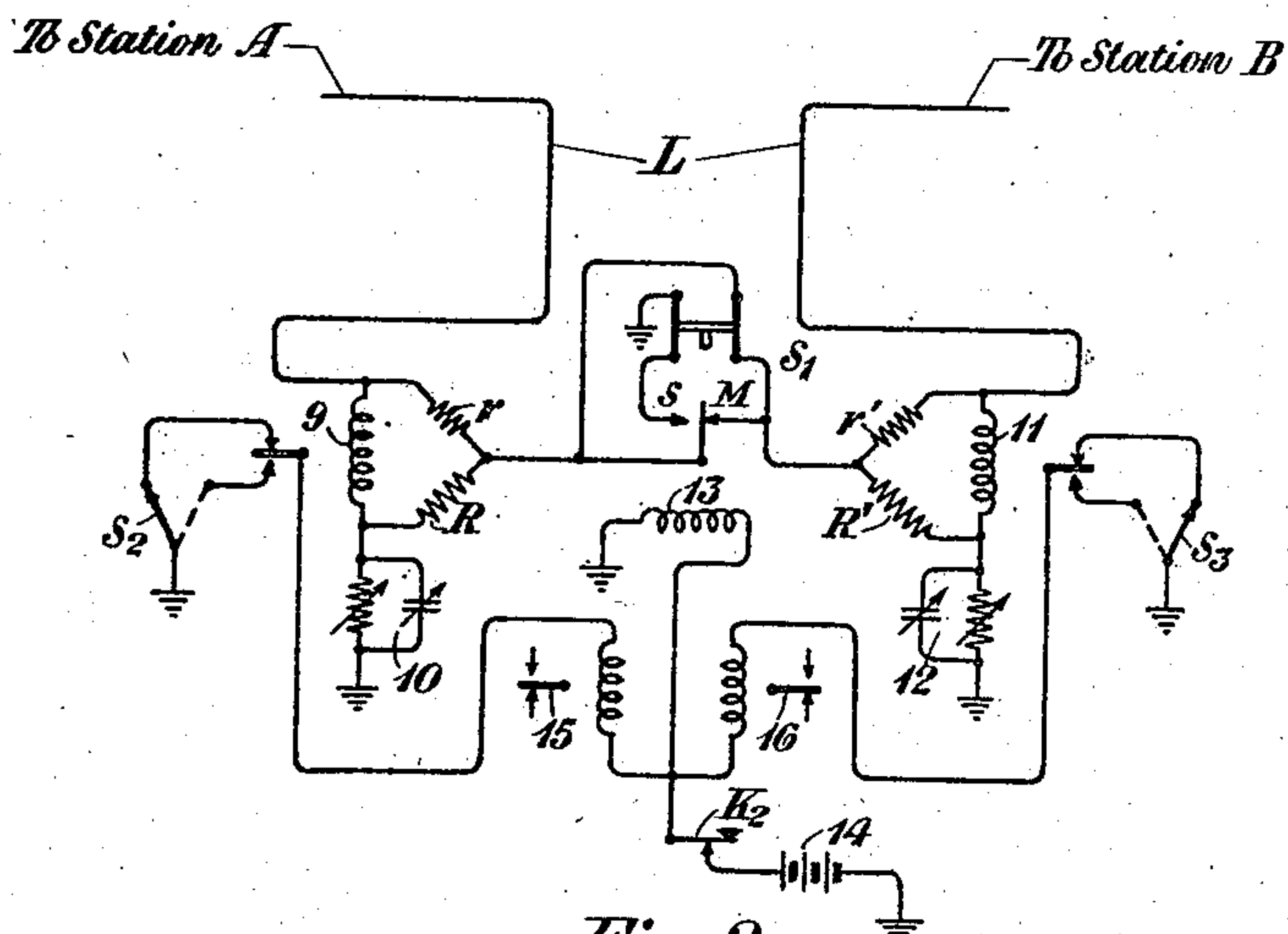


Fig. 2

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INTERMEDIATE TELEGRAPH SET FOR DUPLEX LINES.

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This invention relates to duplex telegraph circuits and more particularly to improvements in intermediate telegraph sets for use with such circuits.

5 The intermediate telegraph set of this invention will, when associated with a duplex circuit, provide full duplex reception from either of the terminal stations and half duplex transmission to either of said sta-
10 tions. It is especially useful for monitoring purposes and effects considerable economies in equipment over previous arrangements. The intermediate set gives improved quality in the signals received and also has very lit-
15 tle effect upon the telegraph circuit with which it is associated. Further features and objects of the invention will appear more fully from the detailed description hereinafter given.

20 The invention may be more fully understood from the following description together with the accompanying drawing in the Figures 1 and 2 of which are illustrated circuit diagrams of the arrangements of the
25 invention.

In Fig. 1 are shown two telegraph stations A and B interconnected by a line L. These terminal stations are provided with full duplex equipment. At station A is shown a transmitting relay 1 controlled by the key K and operating its armature to transmit
30 signals out over the line. A receiving relay 2 is shown and a balancing artificial line N_A . The relay 2 by its armature controls circuit 3 in which is included a sounder 4 for the reception of the signals. At station B is provided similar equipment comprising a key K_1 controlling the transmitting relay 5 and a receiving relay 6 controlling the
35 circuit 7 and the sounder 8.

40 The intermediate set is shown as located at any desired position in the line and the apparatus therefor is included within the dotted lines. The receiving apparatus of the intermediate set consists of two polar
45 relays 9 and 11. These relays each have two windings and these windings are connected differentially into the circuit in opposite directions as shown. The relay 9
50 has an artificial line 10 connected from the end of one of its windings to ground. The relay 11 has an artificial line 12 connected from the end of one of its windings to ground. By proper adjustment of these ar-
55 tificial lines the receiving relays can be made

responsive to signals from only one of the terminal stations and will not be affected by signals from the other station. As this is a well known principle of duplex balance no further description thereof will be given. 60
Instead of repeating the signals by connecting the receiving relay armature of one of the relays to the apex of the windings of the other relay and using positive and negative batteries on the relay contacts, as would 65
be done in a direct point repeater, the two apexes of the relay windings are connected directly together. As a result, one winding of each relay is connected to ground through its artificial line and the other wind- 70
ing is in series with the line. In order to avoid an appreciable effect upon the terminal sets at the stations A and B due to the ground connection through the two artificial lines 10 and 12, the windings of the 75
receiving relays 9 and 11 have an unequal turn ratio. One winding of each relay will have a small number of turns and will be connected into the real line. The other windings will have a large number of turns 80
and will be connected into the artificial lines. Consequently, the impedance of each of the artificial lines 10 and 12 will be considerably larger than that of the section of the line which it balances and the effect upon the 85
line of impedance will be small. It is evident that this effect can theoretically be made as small as desirable by choosing a suitable turn ratio for the two relay windings. The armatures and contacts of the 90
two receiving relays 9 and 11 control the separate sounders 15 and 16 respectively, so that the simultaneous transmission from the two terminal stations may be observed. The switches S_2 and S_3 are connected to the 95
relay contacts so that the received signals may be reversed in case the batteries at the terminal stations are reversed.

To transmit from the intermediate set the key K_2 is operated. This operates the two 100
sounders 15 and 16, and the transmitting relay 13; all of which are connected to the local battery 14. If batteries of like polarity are used for marking and spacing at the terminal stations, the line current will be zero 105
when the sending keys K and K_1 at the terminal stations are closed. In this case the line must be grounded at the intermediate station to transmit a spacing signal to the terminals. For this condition the switch S_1 110

is closed as shown on the drawing. The closing of switch S_1 connects a ground to the spacing contact of relay 13. Accordingly, when the key K_2 is opened, a ground will be applied to the line and a spacing signal sent to the terminal stations. It is pointed out that the armature and marking contact of relay 13 are connected together and to the line. Accordingly, the line circuit will be normal when the key K_2 is closed and through transmission can take place. When the batteries at one of the terminal stations are reversed, the line current will have its full value when the sending keys K and K_1 at the terminal stations are closed. Under these conditions the switch S_1 is left open and the operation of relay 13 will then open the line for a spacing signal and close it for a marking signal.

It is pointed out that the operation of the sending relay 13 will not operate either of the receiving relays 9 and 11 under any of the above conditions provided a good balance has been obtained by means of the artificial lines 10 and 12. These relays, as has been pointed out, are affected only by a reversal of battery at the terminal stations A and B. Accordingly, it is possible to transmit a "break" signal to the intermediate set from either terminal station. Such a "break" signal will be noticeable by the failure of one or both of the sounders 15 and 16 to operate while signals are being transmitted by means of the key K_2 . This failure is due to the operation of the receiving relays 9 and 11 by the opening of the sending keys at the terminal stations and indicates a desire of the operator at the terminal station to interrupt the operator at the intermediate set.

In Fig. 2 is shown an alternative arrangement of the intermediate set of the invention in which the receiving relays 9 and 11 instead of being shown as of the differential duplex type, are shown as of the bridge duplex type. In the differential duplex type the ratio arms consist of the relay windings themselves. In the bridge type the ratio arms are impedances r and R , and r' and R' , and are of uneven ratio. The impedances R and R' would be large with respect to r and r' . This is to cause the impedance of the balancing artificial lines to be considerably larger than the sections of the lines balanced so that the effect upon the attenuation and line impedance will be small. The principles of operation will be the same as heretofore explained, with respect to the arrangements of Fig. 1. Similar reference characters denote like parts in both figures of the drawing.

While the invention has been disclosed in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and widely

varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two receiving relays each having two windings, one winding of each relay being connected serially in the line and the other windings being connected to ground through variable balancing artificial lines, said windings of each relay having different turn ratios.

2. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two receiving relays each having two windings, the apexes of the windings of each of said relays being connected together, the windings of said relays being associated with the line so as to be differentially arranged with respect to currents transmitted over said line in opposite directions and having unequal turn ratios, and variable balancing artificial lines associated with said relay windings.

3. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two receiving relays each having two windings, the apexes of the windings of each of said relays being connected together, the windings of said relays being associated with the line so as to be differentially arranged with respect to currents transmitted over said line in opposite directions and having unequal turn ratios, variable balancing artificial lines associated with said relay windings, a transmitting circuit including a transmitting relay at said intermediate set, and switching means whereby said line may be opened or grounded by said transmitting relay.

4. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two receiving relays each having two windings, the apexes of the windings of each of said relays being connected together, the windings of said relays being associated with the line so as to be differentially arranged with respect to currents transmitted over said line in opposite directions and having unequal turn ratios, variable balancing artificial lines associated with said relay windings, a transmitting circuit including a transmitting relay at said intermediate set, switching means whereby said line may be opened or grounded by said transmitting relay, and signal responsive devices under

the joint control of said receiving relays and said transmitting circuit.

5 5. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two duplex receiving relays each having two ratio arms of unequal impedance, one ratio arm of each relay being
10 connected serially in the line and the other ratio arms being connected to ground through variable balancing artificial lines.

15 6. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set associated with said line, said intermediate set including two duplex receiving relays each having two ratio arms of unequal impedance, the apexes of the ratio arms of each
20 of said duplex receiving relays being connected together.

7. A duplex telegraph system comprising two terminal stations, a line interconnecting said stations, and an intermediate set asso-

ciated with said line, said intermediate set 25 including two duplex receiving relays each having two ratio arms, the apexes of the ratio arms of each of said duplex receiving relays being connected together, one of the ratio arms of each of said relays having a 30 greater impedance than the other ratio arm of the relay and being connected to ground through a variable artificial line.

8. A duplex telegraph system comprising two terminal stations, a line interconnecting 35 said stations, and an intermediate set associated with said line, said intermediate set including two duplex receiving windings each having two ratio arms of unequal impedance, the ratio arms of lesser impedance 40 of each relay being connected serially in said line and the ratio arms of greater impedance of each relay being connected to ground through variable balancing artificial lines.

In testimony whereof, I have signed my 45 name to this specification this 18th day of November 1924.

JOSEPH HERMAN.