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TELEGRAPH SYSTEM

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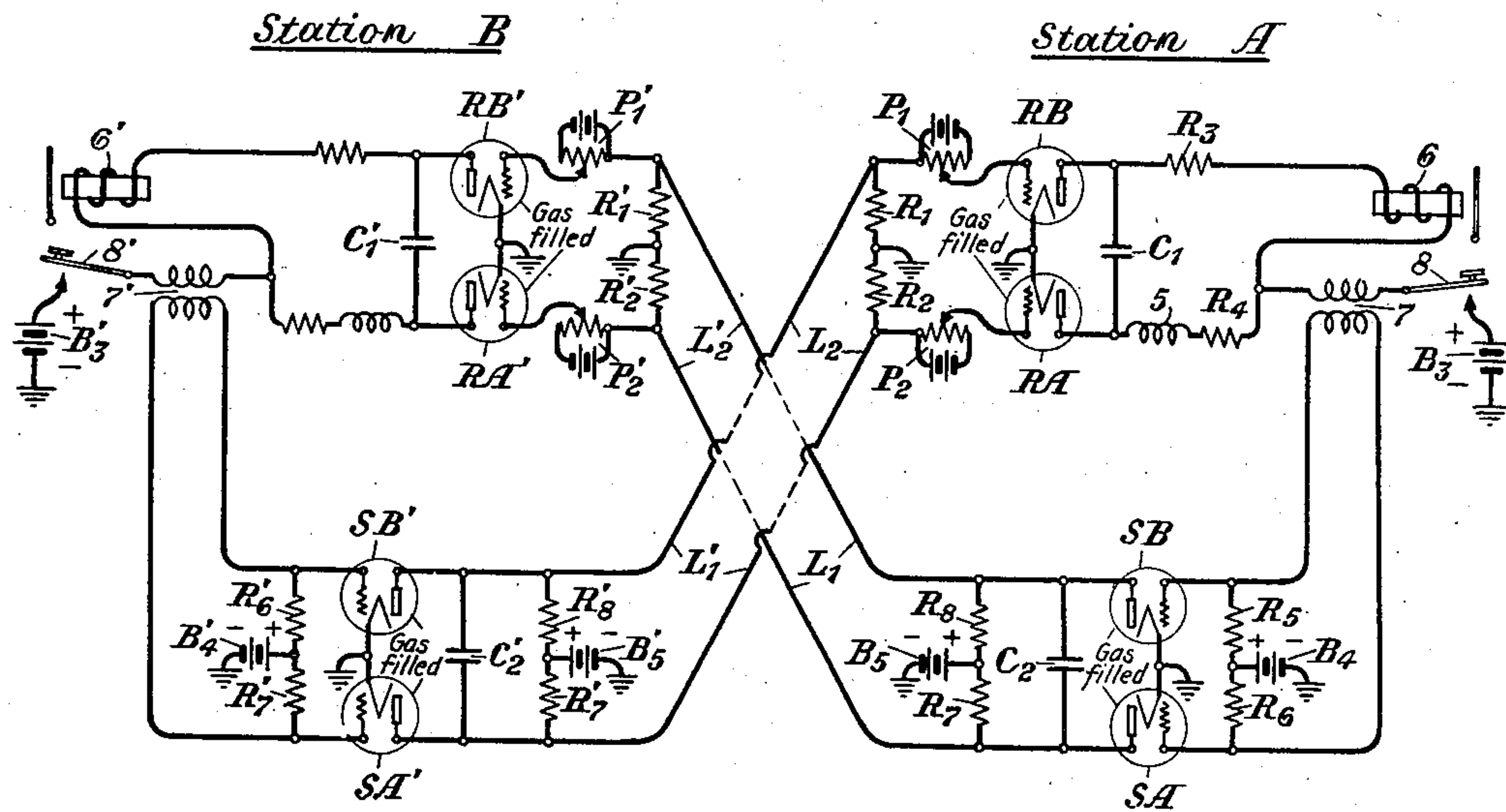


Fig. 1

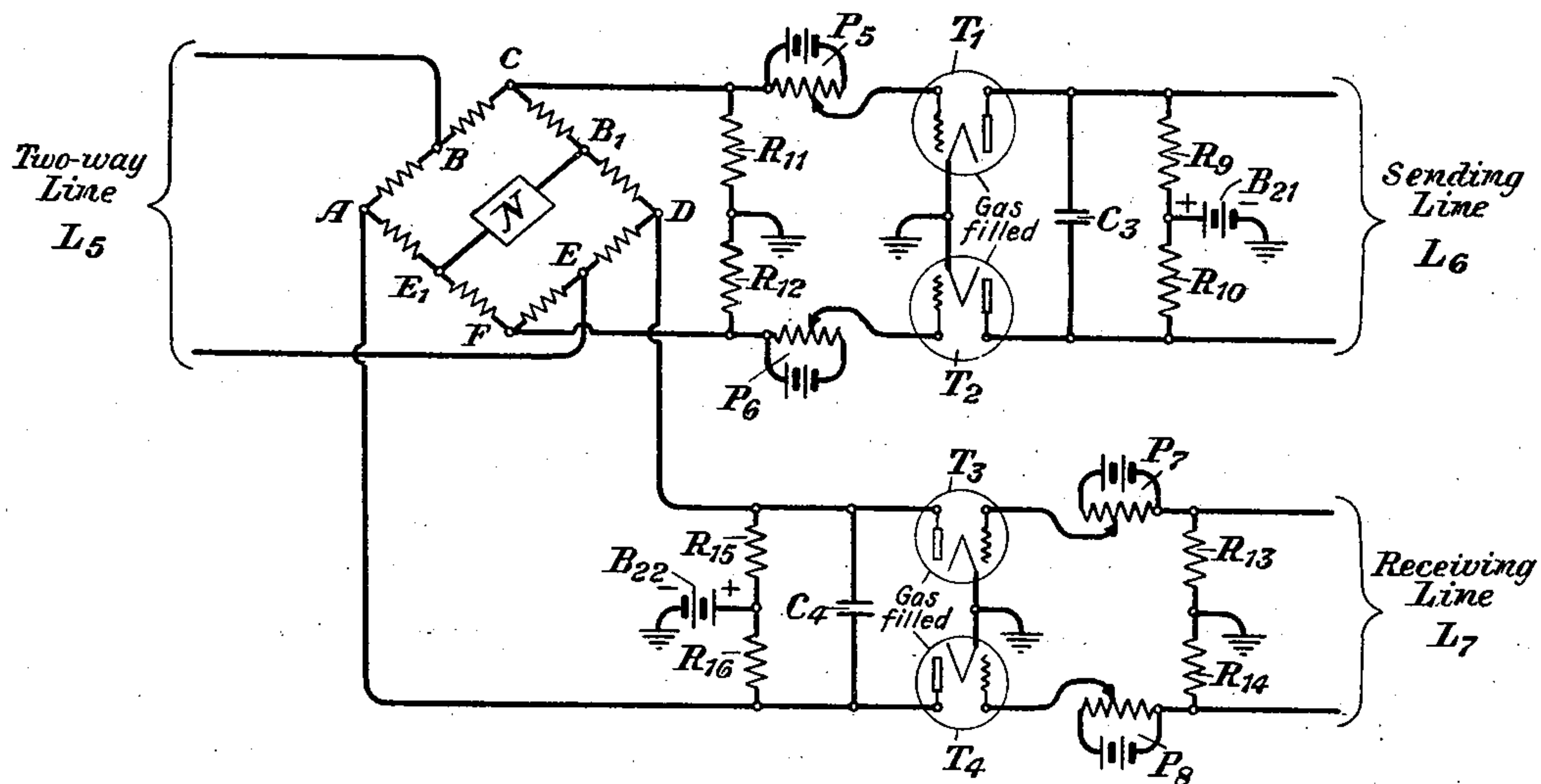


Fig. 2

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TELEGRAPH SYSTEM

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5 Claims. (Cl. 178—71)

This invention relates to telegraph systems and more particularly to improved repeater arrangements utilized in such systems.

In the arrangements of this invention the telegraph repeater comprises a plurality of gas filled discharge tubes and circuit arrangements therefor whereby the usual magnetic relay arrangements may be eliminated. The arrangements of the invention accordingly provide a means for eliminating the expensive maintenance of the electromagnetic type of relay. The arrangements of the invention furthermore provide a repeater which is more reliable at high speeds than prior arrangements. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawing, in Figures 1 and 2 of which are shown circuit diagrams illustrating a preferred embodiment of the invention and a modification thereof.

In Fig. 1 is shown a telegraph system interconnecting the stations A and B. At station A is shown a receiving circuit L_2 . Connected in each side of the receiving circuit L_2 are the gas filled discharge tubes RB and RA. These gas filled discharge tubes would have a common plate circuit which would be completed through the primary winding of a transformer 7, the sending key 8, and battery B_3 . In the portion of the plate circuit individual to tube RB there would be provided the sounder 6. Connected to the transformer 7 would be a sending circuit L_1 . This sending circuit would have included in each side thereof the gas filled discharge tubes SB and SA. The operation of the tubes SB and SA serves to apply marking or spacing signals to the sending circuit L_1 . In the receiving circuit the tubes RB and RA respond, respectively, to marking or spacing signals transmitted over the receiving circuit L_2 . At the station B would be provided apparatus identical to that at the station A. Accordingly, at station B similar reference characters with the added designation prime (') have been utilized to denote devices similar to those at station A.

The operation of the arrangements of the invention shown in Fig. 1 is as follows:

If signals are being transmitted from station B to station A, marking or spacing signals will be received over the circuit L_2 and will be received over resistances R_1 and R_2 . A marking signal will cause the grid of the gas filled tube RB to be made more positive through poten-

tiometer P_1 . This will cause the tube RB to operate and become conductive, thus permitting a direct current to flow over the following circuit from ground, battery B_3 , contacts of key 8, primary winding of transformer 7, winding of sounder 6, resistance R_3 , plate and filament tube RB to ground. This will operate the sounder 6 at station A. When the tube RB becomes conductive, the potential on the plate drops from the full battery potential of battery B_3 to the normal sustaining voltage needed to maintain the tube conductive. When this takes place, the plate of tube RA, which tube was previously conductive, is made sufficiently negative with respect to its cathode to cause the tube RA to be extinguished. This is due to the connection of the condenser C_1 between the plates of the tubes RB and RA. This condenser arrangement, whereby the operation of either of the tube RB or RA will cause the release of the other tube, is an arrangement well known in the art. The impedance of R_3 and the winding of sounder 6 should be duplicated by the impedance of the winding 5 and the resistance R_4 . With these impedances equal there will be no potential generated in the secondary winding of transformer 7 from the primary winding thereof when signals are being received. Accordingly, the reception of signals will have no effect on the sending circuit L_1 and the received signals will not be transmitted back over the line. When a spacing signal is received over the receiving circuit L_2 the tube RA will operate and become conductive and by means of condenser C_1 will cause the tube RB to be extinguished. This will reduce the current through the sounder 6 to zero and the sounder will be released. However, as has been pointed out, no change in current flow through the primary winding of transformer 7 will take place and the signals will not be repeated back over the line.

Signals may be transmitted from the station A to the station B when a marking signal is applied to the receiving circuit L_2 . As heretofore pointed out, a marking signal caused the operation of tube RB. The opening and closing of the key 8 will now cause a variation in the current flow through the primary winding of transformer 7 and will furthermore operate the sounder 6. When the key 8 is closed the current flow through the transformer 7 will flow through resistances R_5 and R_6 in such a direction as to operate the tube SB. The operation of the tube SB will cause a current to flow from battery B_3 through resistance R_8 , and from the plate to the filament of tube SB to ground. This will transmit a marking impulse

over the sending circuit L_1 . When the key 8 is opened the current flow through the transformer 7 will flow through resistances R_5 and R_6 in such a way as to operate the tube SA. The operation of tube SA will cause a current to flow from battery B_5 through resistance R_7 and the plate and filament of tube SA to ground and this will apply a spacing signal to circuit L_1 . Due to the condenser C_2 the operation of the tube SA will cause the tube SB to become extinguished. Also, the operation of tube SB will through the action of condenser C_2 cause the tube SA to become extinguished.

When the operator at station B wishes to break or interrupt the operator at station A when he is sending, the operator at station B will open his key and apply a spacing signal to the receiving circuit L_2 . The operator at station A will thus know that the distant operator wishes to interrupt his sending and he will close the key 8 and apply a marking signal to the sending circuit L_1 . This will place the line in condition for the transmission of signals from station B to station A. If this spacing signal is received during the period when sending key 8 is closed, the sounder 6 will be put in spacing condition as long as the spacing signal is received, thus giving the operator at station A a positive indication of the "break" as coming over the line L_2 . If this spacing signal is received during the period when the sending key 8 is open, the tube RA will not operate since its plate is opened up at key 8. When the operator closes his key 8, and the sounder 6 does not respond, he will have a positive indication that a "break" is coming over the line L_2 . The operator at station A will thus know that the distant operator wishes to interrupt his sending and he will close the key 8 and apply a marking signal to the sending circuit L_1 . This will place the line in condition for the transmission of signals from station B to station A.

As the operation of the arrangements at station B is identical with that already described for station A, no detailed description thereof will be given.

In Fig. 2 is shown an arrangement whereby the gas filled tube repeater device of the invention may be utilized to interconnect a two-way line of the polar duplex type to two one-way lines. The two-way line L_5 may be connected at its other end to a similar repeater of either the tube or relay type or the line may be the open or closed type of loop without a repeater as desired. The two-way line L_5 and the two one-way lines L_6 and L_7 are connected together by the double Wheatstone bridge ACDF in a manner similar to a hybrid connection for voice frequency circuits. The sending line L_6 and the receiving line L_7 are connected at conjugate points AD and CF so as to prevent signals coming in over line L_7 from being repeated back over line L_6 . The duplex line L_5 is connected to intermediate points BE on the bridge and a balancing network N is connected to the intermediate points B_1E_1 in order to preserve the balance of the bridge. The type of Wheatstone bridge arrangement shown is substantially similar to that illustrated in United States Patent No. 1,681,216, issued August 21, 1928, to D. E. Branson et al.

Marking or spacing signals coming in over line L_7 will be received over resistance R_{13} or R_{14} and will cause the operation of either tube T_3 or T_4 . Because of the condenser C_4 the operation of one of these tubes will cause the release of the other. By means of battery B_{22} and resistance R_{15} or R_{16}

the operation of one tube may apply a marking signal to line L_5 and the operation of the other tube may apply a spacing signal to line L_5 . In a like manner marking or spacing signals coming in over line L_5 will be received over resistances R_{11} and R_{12} and may cause the operation of either tube T_1 or T_2 . These tubes in like manner may then apply to line L_6 either marking or spacing signals. As the details of operation are substantially similar to those already described with respect to Fig. 1 no further description thereof will be given.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In a telegraph system interconnecting two stations, a receiving circuit and a transmitting circuit at one of said stations, two gas filled discharge tubes each connected in different sides of said receiving circuit, means for operating one of said tubes when a marking signal is applied to said circuit at a distant station and the other of said tubes when a spacing signal is applied to said circuit at the distant station, means controlled by the operation of either tube for causing the release of the other tube, plate circuits of equal impedance for each of said tubes, a transformer, means for completing the plate circuits of said tubes through the primary winding of said transformer whereby the alternate operation of said tubes will not change the current flow through said primary winding, and means for connecting said sending circuit to the secondary winding of said transformer.

2. In a telegraph system interconnecting two stations, a receiving circuit and a transmitting circuit at one of said stations, two gas filled discharge tubes each connected in different sides of said receiving circuit, means for operating one of said tubes when a marking signal is applied to said circuit at a distant station and the other of said tubes when a spacing signal is applied to said circuit at the distant station, means controlled by the operation of either tube for causing the release of the other tube, plate circuits of equal impedance for each of said tubes, receiving apparatus in one of said plate circuits, a transformer, means for completing the plate circuits of said tubes through the primary winding of said transformer whereby the reception of marking and spacing signals over said receiving circuit will not change the current flow through said primary winding, and means for connecting said sending circuit to the secondary winding of said transformer.

3. In a telegraph system interconnecting two stations, a receiving circuit and a transmitting circuit at one of said stations, two gas filled discharge tubes each connected in different sides of said receiving circuit, means for operating one of said tubes when a marking signal is applied to said circuit at a distant station and the other of said tubes when a spacing signal is applied to said circuit at the distant station, means controlled by the operation of either tube for causing the release of the other tube, plate circuits of equal impedance for each of said tubes, receiving apparatus in one of said plate circuits, a transformer and transmitting apparatus, means for completing the plate circuits of said

tubes through the primary winding of said transformer whereby the reception of marking and spacing signals over said receiving circuit will not change the current flow through said primary winding, means for connecting said sending circuit to the secondary winding of said transformer, and means in said sending circuit for transmitting marking and spacing signals thereover, said last mentioned means being controlled by the operation of said transmitting means.

4. In a telegraph system interconnecting two stations, a receiving circuit and a transmitting circuit at one of said stations, two gas filled discharge tubes each connected in different sides of said receiving circuit, means for operating one of said tubes when a marking signal is applied to said circuit at a distant station and the other of said tubes when a spacing signal is applied to said circuit at the distant station, means controlled by the operation of either tube for causing the release of the other tube, plate circuits of equal impedance for each of said tubes, receiving apparatus in one of said plate circuits, a transformer and transmitting apparatus, means for completing the plate circuits of said tubes through the primary winding of said transformer whereby the reception of marking and spacing signals over said receiving circuit will not change the current flow through said primary winding, means for connecting said secondary winding of said transformer, two gas filled discharge tubes each connected in different sides of said transmitting circuit, means controlled by the operation of one of said tubes for applying a marking signal to said sending circuit, means controlled by the operation of the other of said tubes for applying a spacing signal to said sending circuit, and means controlled by the operation of either one of said tubes in said sending circuit for causing the release of the other tube, the operation of said tubes in said

sending circuit being controlled by the operation of said transmitting means.

5. In a telegraph system interconnecting two stations, a receiving circuit and a transmitting circuit at one of said stations, two gas filled discharge tubes each connected in different sides of said receiving circuit, means for operating one of said tubes when a marking signal is applied to said circuit at a distant station and the other of said tubes when a spacing signal is applied to said circuit at the distant station, means controlled by the operation of either tube for causing the release of the other tube, plate circuits of equal impedance for each of said tubes, receiving apparatus in one of said plate circuits, a transformer and transmitting apparatus, means for completing the plate circuits of said tubes through the primary winding of said transformer whereby the reception of marking and spacing signals over said receiving circuit will not change the current flow through said primary winding, means for connecting said sending circuit to the secondary winding of said transformer, two gas filled discharge tubes each connected in different sides of said transmitting circuit, means controlled by the operation of one of said tubes for applying a marking signal to said sending circuit, means controlled by the operation of either one of said tubes in said sending circuit for causing the release of the other tube, means controlled by the operation of said transmitting apparatus when a marking signal is applied to said receiving circuit for controlling the operation of said receiving apparatus, and means controlled by the application of a spacing signal to said receiving circuit for preventing the operation of said transmitting apparatus from controlling the operation of said receiving apparatus.

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