July 5, 1927.

J. HERMAN

1,634,286

TELEGRAPH CIRCUITS

Filed Oct. 30, 1925

2 Sheets-Sheet 1

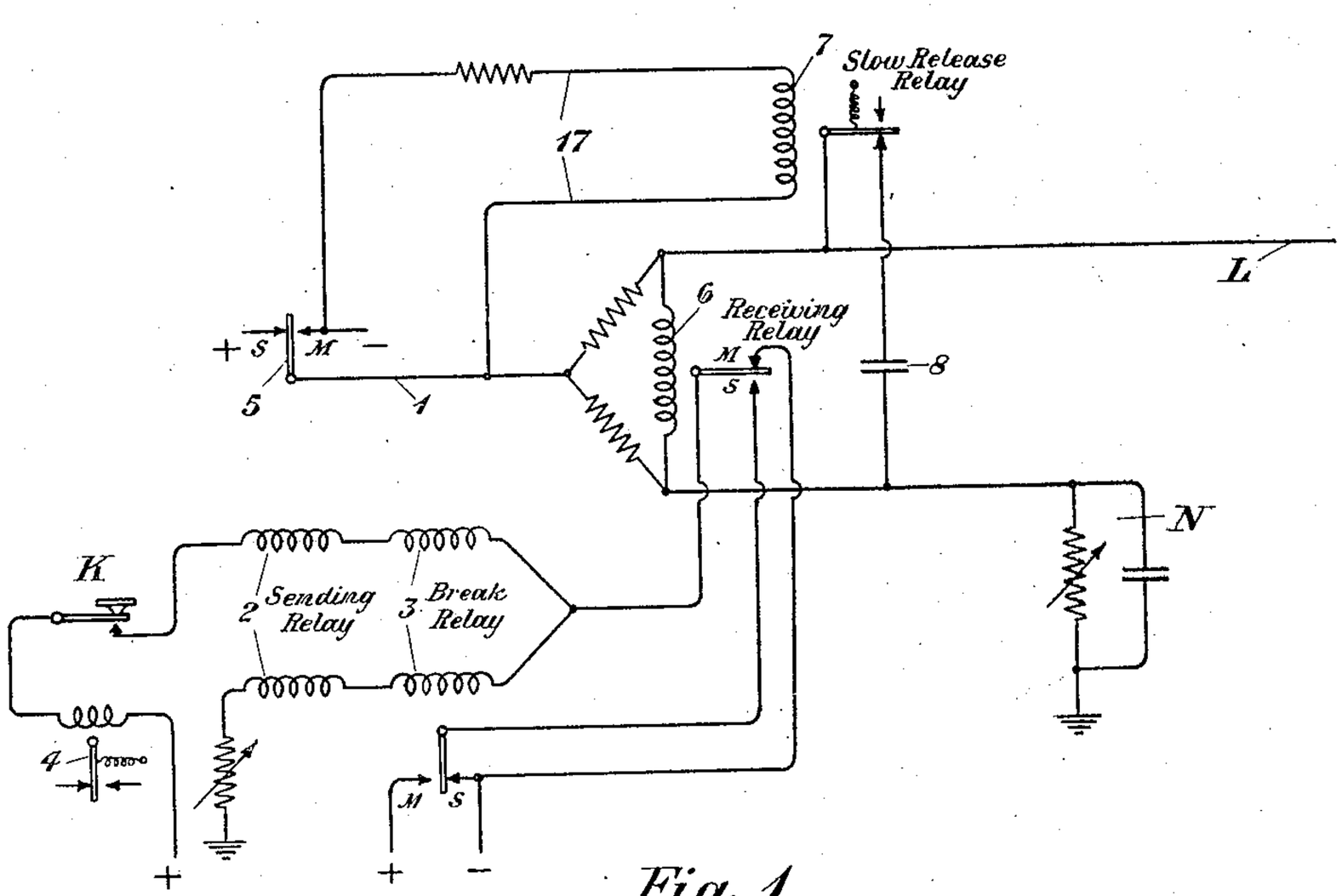

Fig. 1

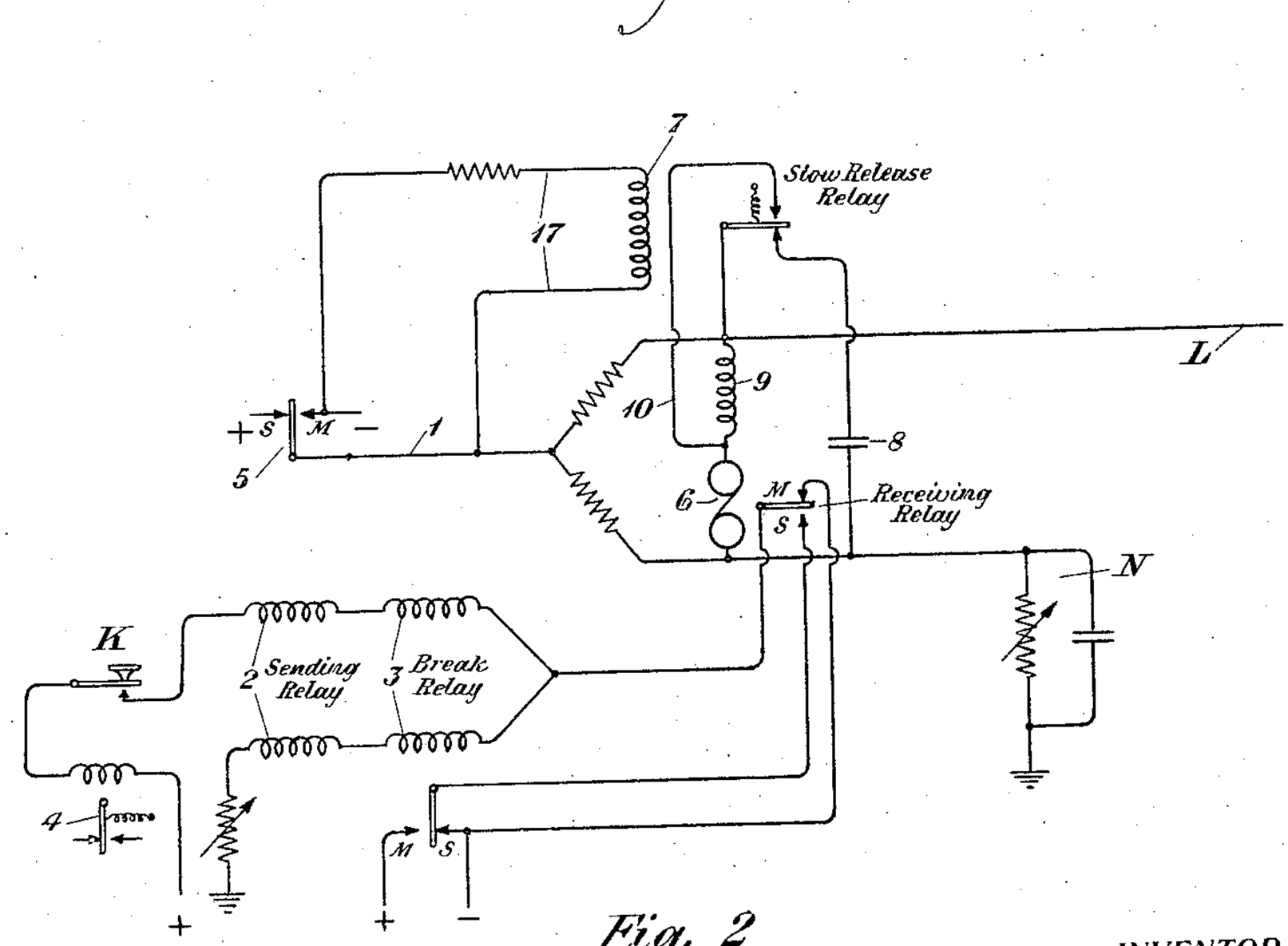

Fig. 2

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2 Sheets-Sheet 2

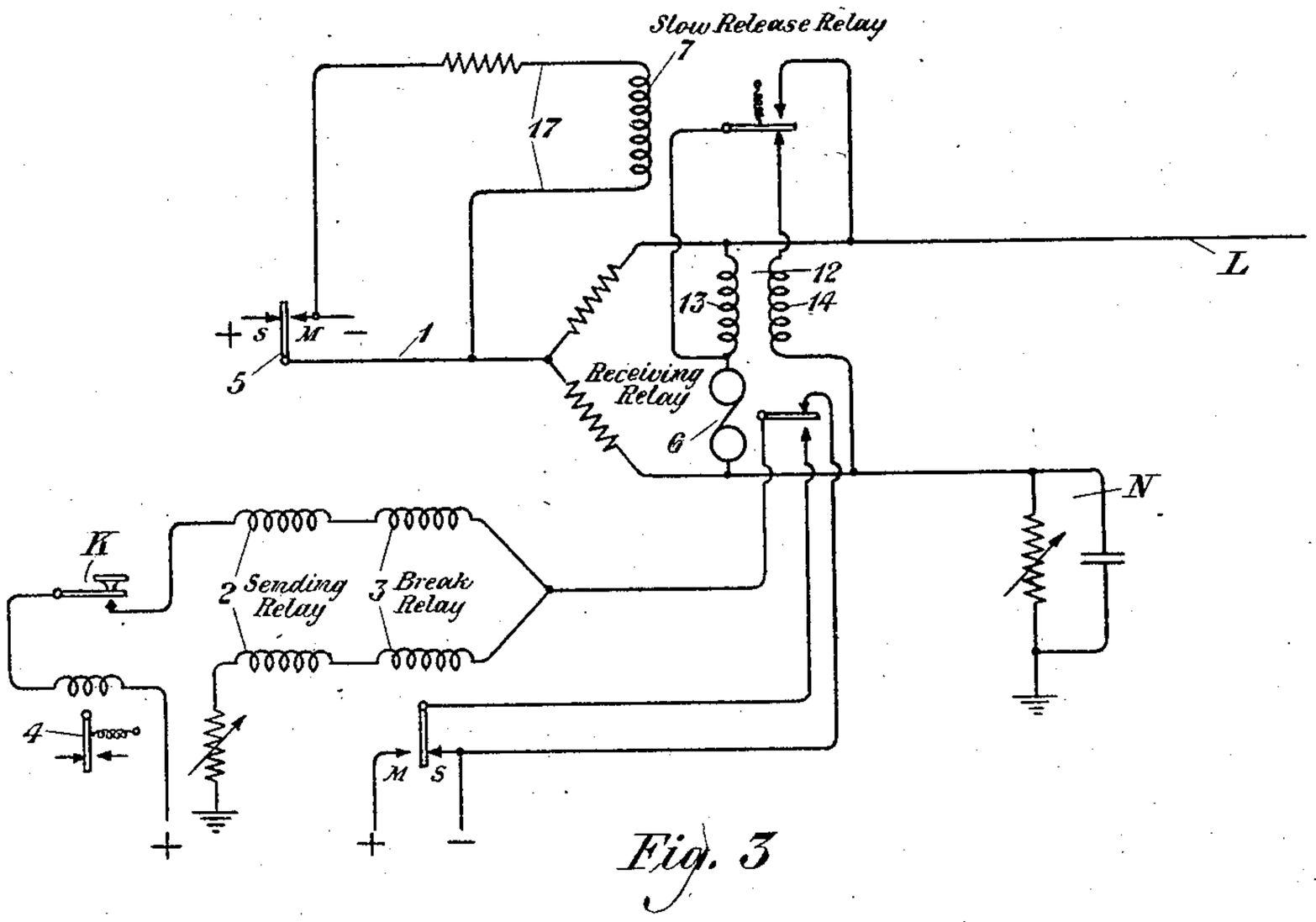

Fig. 3

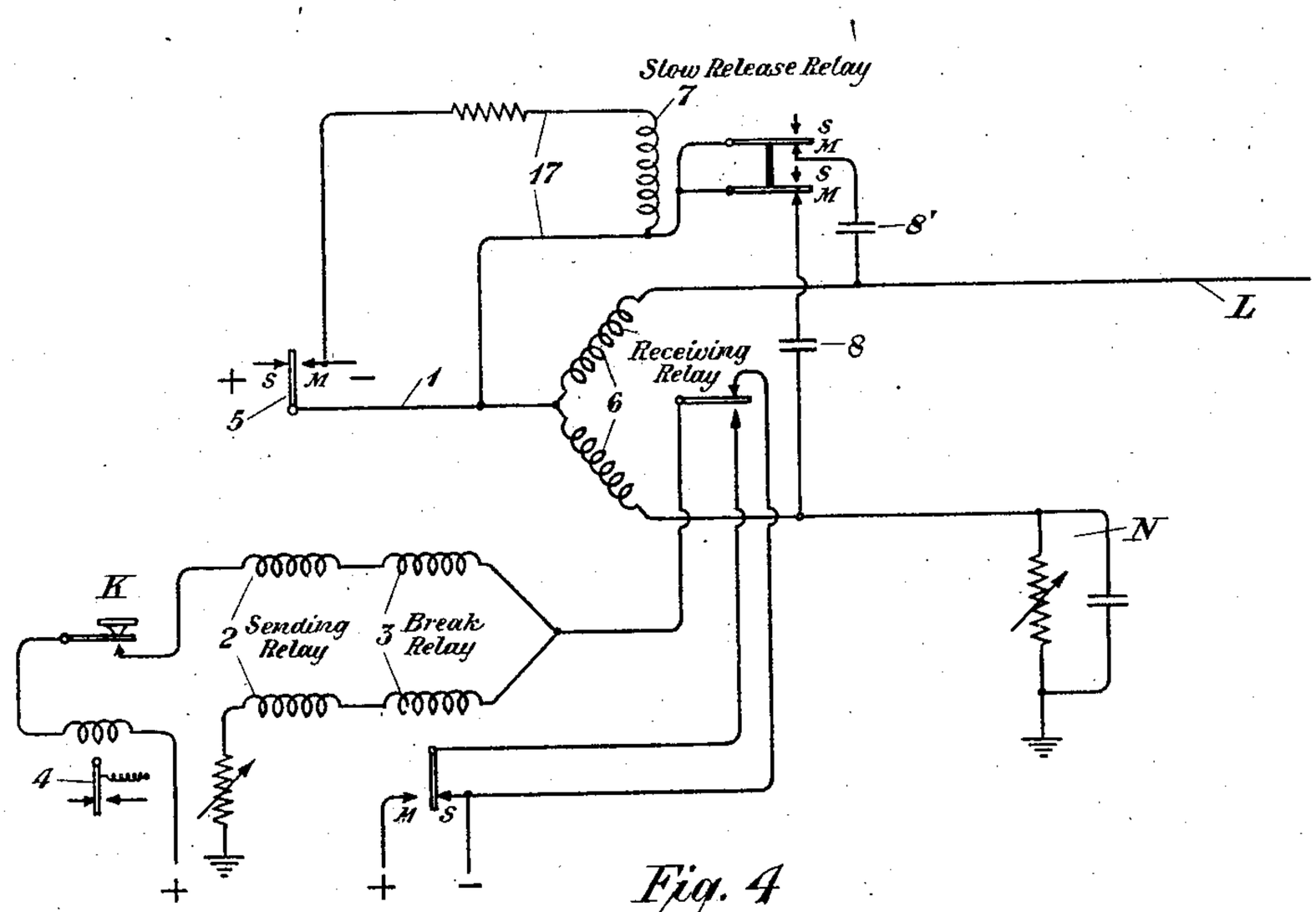

Fig. 4

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UNITED STATES PATENT OFFICE.

JOSEPH HERMAN, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEGRAPH CIRCUITS.

Application filed October 30, 1925. Serial No. 65,874.

This invention relates to signaling systems, and more particularly to improvements in telegraph signaling systems of the half duplex type.

The primary object of the arrangements of the invention is to make it possible to satisfactorily operate half duplex telegraph sets wherein the condition of balance between the real and artificial lines is much poorer than heretofore. It is well known that, in the case of half duplex telegraph operation in which transmission is intermittently in one direction or the other and not simultaneously in both directions, an absolutely accurate duplex balance is not required. An accurate direct current balance is necessary, however, to prevent introducing bias into the received signals. In practice, it is found, however, that a fairly accurate alternating current balance must also be maintained, even on half duplex circuits, to prevent the receiving relay from being operated by the local transmitting current. Consequently, it has sometimes been the practice to provide the same expensive artificial lines for half duplex as for full duplex sets. While this has the advantage that all telegraph sets can then be used for either type of service, nevertheless, it adds greatly to the first cost and maintenance expense because a large portion of the telegraph service is apt to be of the half duplex type. Furthermore, in the case of lines having a large number of intermediate composite sets or similar equipment, it is frequently impossible to get a satisfactory balance with the standard artificial lines provided on telegraph sets. For this reason, such circuits are sometimes divided into several sections, thereby necessitating the use of additional telegraph repeaters. In general the arrangements of the invention are intended to eliminate the above enumerated disadvantages and to permit satisfactory half duplex operation over circuits which would otherwise require special balancing artificial lines or additional repeaters. Other features and purposes of the invention will appear more fully from the detailed description hereinafter given.

Primarily the arrangements of the invention consist of a low-pass filter and a slow acting switching relay. The latter is so connected to the telegraph set as to remain operated while the transmitting relay is operating. Under this condition, the filter is connected into the receiving relay circuit so as to make the receiving relay insensitive to alternating current unbalances. When the transmission from the telegraph set stops and the transmitting relay rests on its marking contact an appreciable length of time, as is the case when the operator stops sending or when the distant operator opens his key to interrupt the sending operator, the slow acting relay removes the filter and restores the sensitivity of the receiving relay. Consequently, the reception of signals is not affected by the arrangement.

The invention may be more fully understood from the following detailed description thereof together with the accompanying drawing in the Figures 1, 2, 3 and 4 of which are shown a preferred form of the invention and various modifications thereof. Similar reference characters have been utilized to denote like parts in all of the figures.

In Fig. 1 is shown a half duplex telegraph set equipped with one form of arrangements of the invention. The half duplex telegraph set comprises a line L and a balancing artificial line N. Connected to the apex of the line and artificial line branches is a circuit 1 connected to the armature 5 of a sending relay 2. The sending relay 2 and the break relay 3 are shown together with the operator's key K and a sounder 4. The windings of the break relay are connected, as shown, to the armature of a receiving relay 6 which is bridged across the line and artificial line branches in the usual manner. In addition to the above mentioned usual apparatus there is provided a slow release relay 7 and a condenser 8 which is bridged across the line and artificial line branches over the contacts of the slow release relay 7. The winding of the slow release relay 7 is connected by circuit 17 to the marking contact of the sending relay 2 and the conductor 1 in the manner shown.

When the operator operates the key K so as to transmit signals to the distant station, he causes the operation of the transmitting relay 2. While the armature of the transmitting relay rests on the S or spacing contact, current from the transmitting batteries flows through the winding of the relay 7 causing it to operate. When the armature 5 rests on the M or marking contact, the winding of relay 7 is short circuited, there-

by tending to make this relay release. However, owing to the slow release feature which is incorporated into the construction of relay 7, it remains operated as long as the armature of the sending relay continues to move back and forth between the contacts M and S. During the time that relay 7 remains operated, the condenser 8 is connected across the winding of receiving relay 6. If the condenser 8 is made sufficiently large in capacity, it will short circuit the receiving relay for alternating current impulses which are generated by the unbalance between the real and artificial lines. It is evident, however, that such will not be the case for direct current. Consequently, the receiving relay may still be operated by slow reversals of current from the distant station and the distant operator will still be able to interrupt the local operator. For the transmission of a break signal from the distant station, the distant operator opens his key for an appreciable length of time. This causes the receiving relay to operate to its S contact and interrupts the local operator who then closes his key K. The armature of the sending relay 2 remains upon its M contact upon the operation of this series of events and accordingly, the slow release relay 7 will release. This opens the circuit of the condenser 8 and restores the receiving relay to its normal sensitivity. This condition will also take place if the local operator closes his key and stops transmitting, even though a break signal is not received.

In Fig. 2 is shown an alternative form of the invention in which an inductance 9 is connected in series with the windings of the receiving relay 6 and a condenser 8 is shunted across both the inductance 9 and the windings of relay 6. This inductance and capacity operate as a low-pass filter to shut out the alternating currents from the receiving relay 6. When the switch relay 7 releases, it operates to short circuit the inductance 9 and to open the circuit of the condenser 8 and thus remove the filtering arrangement and restore the receiving relay to normal sensitivity.

In Fig. 3 the arrangements for varying the sensitivity of the receiving relay consist of a two-winding transformer 12, having close coupling between the windings. When the relay 7 is operated, the winding 13 of this transformer is connected in series with the winding of the receiving relay 6 and winding 14 is connected in shunt with the receiving relay winding and arranged so as to be series opposing with winding 13. This method of connecting the transformer windings with respect to the receiving relay winding tends to short circuit the alternating current impulses around the receiving relay.

In Fig. 4 is shown an application of the condenser arrangement to a differential receiving relay 6. The drawing shows separate condensers 8 and 8′ each connected across one winding of the receiving relay. However, a single condenser connected across both windings could also be used. The method of utilizing separate condensers has been illustrated, however, as it shows the manner in which the other filter arrangements heretofore described might be applied to the differential type of receiving relay. Suitable switching contacts for the arrangement are provided by the contacts of relay 7. As the operation in other details of the arrangements of Figs. 2, 3 and 4 are substantially the same as those heretofore described with respect to Fig. 1, no further description thereof will be given.

While the invention has been described as embodied in certain specific forms which are deemed desirable, it is understood that it is capable of embodiment in many other 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 set comprising a line section and an artificial line section, a receiving relay associated with both of said line sections, a transmitter circuit connected to the apex of said line sections, an alternating current shunt around said receiving relay, and relay means controlled by said transmitter circuit for operating said shunt.

2. A duplex telegraph set comprising a line section and an artificial line section, a receiving circuit bridged between said line sections, a transmitter circuit connected to the apex of said line sections, a filter, and means controlled by said transmitter for connecting said filter into said receiving circuit.

In testimony whereof, I have signed my name to this specification this 27th day of October 1925.

JOSEPH HERMAN.