May 7, 1929. C. H. FETTER 1,711,562

ECHO SUPPRESSOR CIRCUITS

Filed Oct. 26, 1926

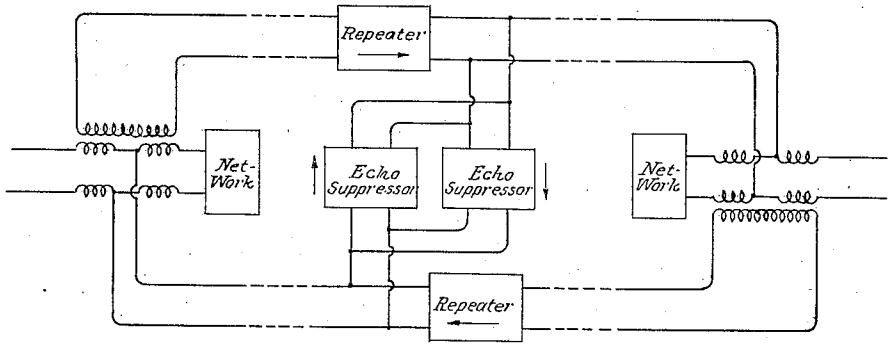


Fig. 1

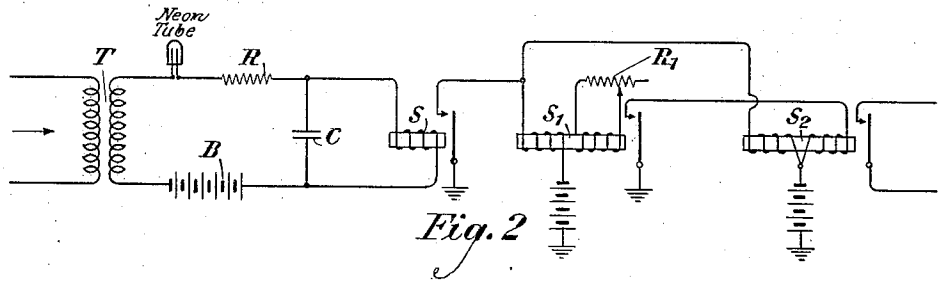


Fig. 2

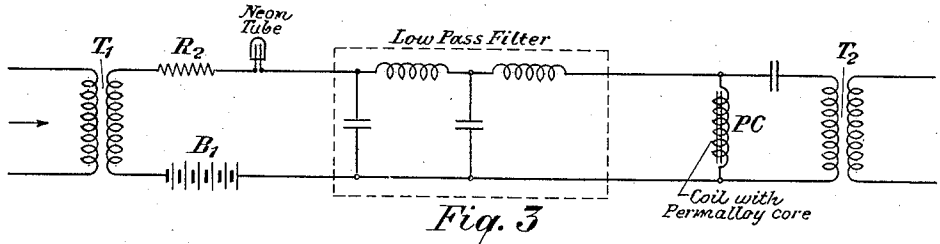


Fig. 3

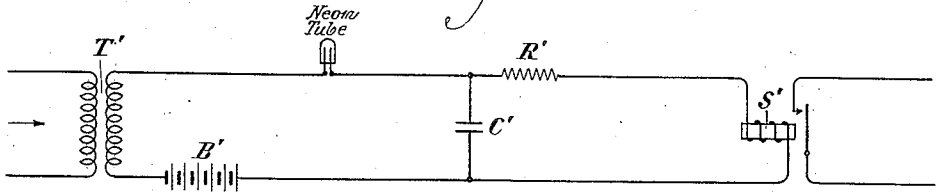


Fig. 4

INVENTOR.
C. H. Fetter
BY
ATTORNEYS.

Patented May 7, 1929. 1,711,562

UNITED STATES PATENT OFFICE.

CHARLES H. FETTER, OF MILLBURN, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ECHO-SUPPRESSOR CIRCUITS.

Application filed October 26, 1926. Serial No. 144,378.

This invention relates to echo suppressor circuits which are used on long telephone lines, usually in association with repeater apparatus.

The principal object of my invention is economy of the apparatus for suppressing echoes.

My echo suppressor circuit may be used in place of the echo suppressor apparatus now in use in connection with long telephone lines, and involves the use of a neon tube in association with various types of circuit, as indicated by the following description of three forms of circuit.

My invention will be more clearly understood when the following description is read with reference to the accompanying drawing. Figure 1 of the drawing shows schematically the position of an echo suppressor circuit with respect to the repeater circuit of a telephone system. For a description and explanation of the echo suppressor circuits in use at the present time, reference may be had to an article entitled "Echo suppressors for long distance telephone circuits," by A. B. Clark and R. C. Mathes, Journal of the American Institute of Electrical Engineers, June 1925, page 618 et seq. Figures 2, 3 and 4 of the accompanying drawing show diagrammatically three desirable arrangements of echo suppressor circuits involving my application of the neon tube.

In the arrangement of Fig. 2, the step-up transformer T has its primary winding connected across one of the one-way transmission paths of Fig. 1. A neon tube is associated with the secondary winding of the transformer T in circuit with the winding of the relay S. When the output of the amplifier in the one-way path is sufficient to operate the neon tube, the impedance of the tube, as is well understood in the art, will change from infinity to a finite value, and the circuit through the winding of relay S will be closed, resulting in the operation of the relay. It is desirable that a biasing battery B and a resistance R be connected in the circuit, as shown. In addition, the bypass condenser C may be bridged across the circuit. When relay S operates as a result of the operation of the neon tube, circuits are closed through the windings of relays S_1 and S_2, and the opposite transmission path is short-circuited. This short circuit is maintained for a suitable length of time, dependent upon the value of the external resistance R_1 associated with the relay S_1. This time lag is necessary in order to suppress returning echoes.

Another desirable arrangement of echo suppressor circuit using a neon tube is shown in Fig. 3. In this arrangement, there is a step-up transformer T_1 associated with one transmission path, and a second transformer T_2 having its primary winding connected across the opposite transmission path. The neon tube, the biasing battery B_1 and a resistance R_2 are associated with the secondary winding of the transformer T_1, as shown. A high impedance coil PC, preferably a coil having a permalloy core, is connected across the secondary winding of the transformer T_2. A low-pass filter is interposed between the neon tube and the permalloy coil PC, as shown. The impedance of the coil PC looking into the transformer T_2 from the transmission path with which it is associated is quite high in the normal condition in which no current is flowing through the coil. Accordingly, the normal loss in the repeater circuit path due to the coil PC is negligible. When, however, the output of the transformer T_1 is sufficient, with the aid of the biasing battery B_1, to operate the neon tube, current will flow through the coil PC, and its impedance will be so far decreased that a loss will be introduced in the transmission path sufficient to cause a substantial suppression of the echoes in the transmission circuit. The permalloy coil may be made to have the characteristic that after current has been passed through it, considerable time will be required for the return of its self-impedance. Accordingly, there is provided the necessary delay, after the neon tube has ceased to operate, in the return of full impedance offered to currents flowing in the path associated with the coil PC. The low-pass filter has such values that the proper direct transmission loss between the two paths of the repeater circuit is provided for.

The arrangement shown in Fig. 4 of the drawing has the transformer T', the neon tube, the biasing battery B' and a relay S' corresponding to similar elements of the arrangement of Fig. 2. The relay S' controls the short circuit of the opposite path. The delay in the release of this relay is provided for by the arrangement of the condenser C' and the resistance R' connected in circuit

with the relay winding and associated with the neon tube, as shown. Upon the release of the neon tube, the condenser C′ will discharge through the resistance R′ and the relay winding, and accordingly will hold the relay operated for a suitable period of time, depending, of course, upon the values of the resistance R′ and the capacity of the condenser C′.

It will be understood from the above description that my arrangement of an echo suppressor circuit involves a real simplification of the echo suppressor circuits ordinarily used, and permits of a considerable economy in the apparatus necessarily involved.

While several embodiments of my invention have been described in detail above, it is to be understood that the scope of my invention is not limited thereby, but is defined by the appended claims.

What is claimed is:

1. In a signaling system including wire paths adapted for transmission in opposite directions, a transmission suppressor comprising a transformer having its primary winding connected across one path, a gaseous discharge device associated with the secondary winding of said transformer and adapted to operate on a given voltage, a direct current source in circuit with said gaseous discharge device having a voltage below the operating voltage of said device, and means responsive to the operation of said gaseous discharge device for disabling the opposite path.

2. In a signaling system including wire paths adapted for transmission in opposite directions, an echo suppressor comprising a transformer having its primary winding connected across one path, a neon tube associated with the secondary winding of said transformer and adapted to operate on a given voltage, a direct current source in circuit with said tube having a voltage below the operating voltage of said tube, and means responsive to the operation of said neon tube for short-circuiting the opposite path.

3. In a signaling system including wire paths adapted for transmission in opposite directions, a transmission suppressor circuit comprising a first transformer having its primary winding connected across one path, a second transformer having its primary winding connected across the opposite path, a coil of high normal impedance connected across the secondary winding of said second transformer, and means associated with the secondary winding of said first transformer and adapted to operate on a given voltage to reduce the high normal impedance of said coil.

4. In a signaling system including wire paths adapted for transmission in opposite directions, an echo suppressor circuit comprising a first transformer having its primary winding connected across one path, a second transformer having its primary winding connected across the opposite path, a coil of high normal impedance connected across the secondary winding of said second transformer, a neon tube associated with the secondary winding of said first transformer and adapted to operate on a given voltage to close a circuit through said winding and said coil, and a low-pass filter interposed between said neon tube and said coil.

5. In a signaling system including wire paths adapted for transmission in opposite directions, an echo suppressor circuit comprising a first transformer having its primary winding connected across one path, a second transformer having its primary winding connected across the opposite path, a permalloy coil connected across the secondary winding of said second transformer, a neon tube associated with the secondary winding of said first transformer and adapted to operate on a given voltage to close a circuit through said winding and said permalloy coil, and a low-pass filter interposed between said neon tube and said permalloy coil.

In testimony whereof, I have signed my name to this specification this 21st day of October, 1926.

CHARLES H. FETTER.