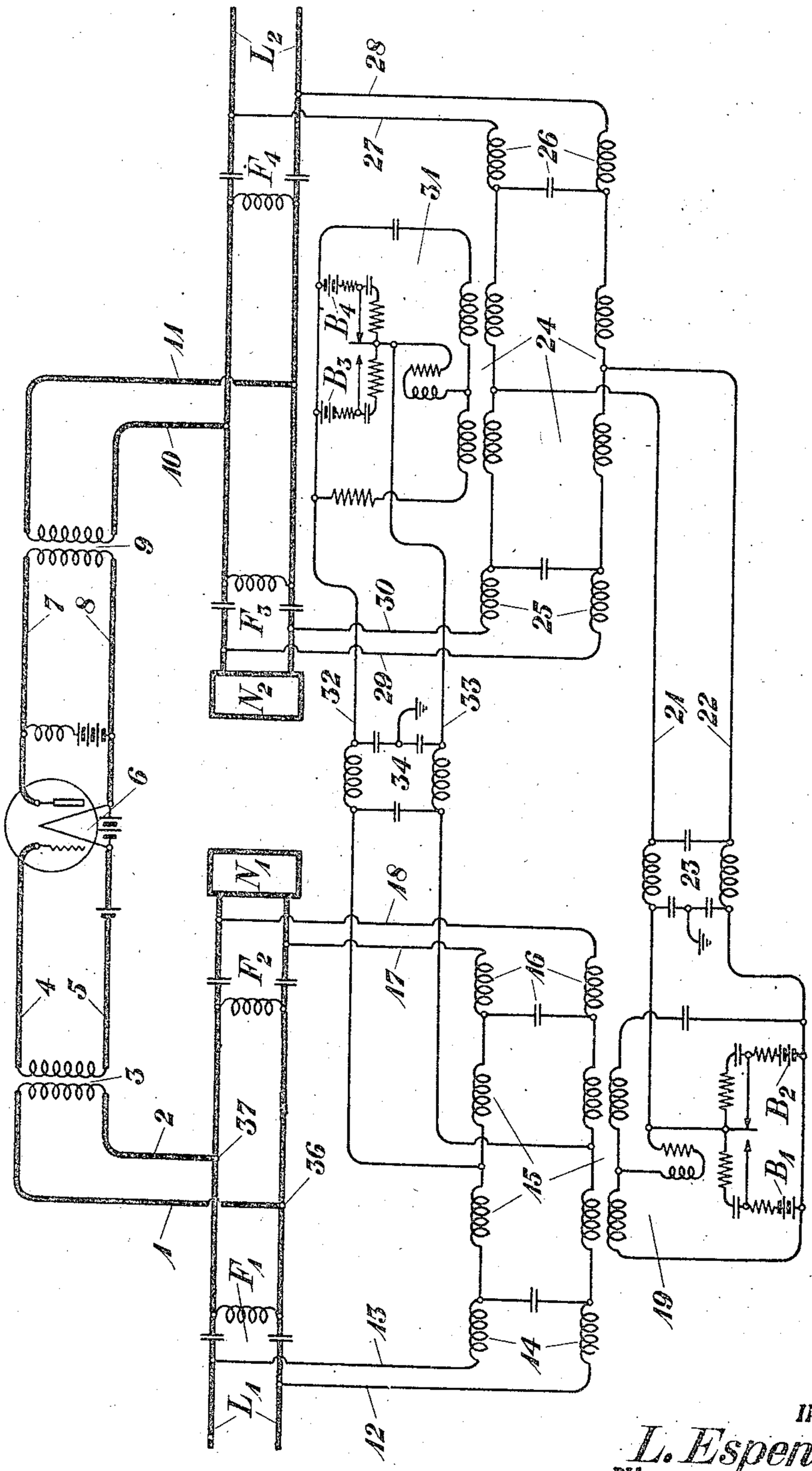
Jan. 9, 1923.

1,441,270.

L. ESPENSCHIED.

TRANSMISSION SYSTEM.

FILED SEPT. 26, 1919.



INVENTOR.

L. Espenschied

BY

ATTORNEY.

Patented Jan. 9, 1923. 1,441,270

UNITED STATES PATENT OFFICE.

LLOYD ESPENSCHIED, OF HOLLIS, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TRANSMISSION SYSTEM.

Application filed September 26, 1919. Serial No. 326,525.

To all whom it may concern:

Be it known that I, LLOYD ESPENSCHIED, residing at Hollis, in the county of Queens and State of New York, have invented certain Improvements in Transmission Systems, of which the following is a specification.

This invention relates to transmission systems, and more particularly to lines arranged for the multiplex transmission of a plurality of currents.

It is desirable to utilize a common transmission line for the multiplex transmission of a plurality of currents so that the line may be used for several purposes at once. This may be accomplished by impressing on the line a plurality of carrier frequencies sufficiently separated from each other to prevent interference and each frequency being assigned for use as a separate channel of communication so that signals, such, for instance, as telephonic variations may be transmitted by impressing them upon the carrier frequencies. Several channels may thus be superposed upon a common transmission line and each channel performs the functions of an ordinary telephone transmission line. In addition to superposing a plurality of carrier channels on a line for telephone purposes it may be desirable to also superpose a carrier channel for purposes such as ringing or signaling. Furthermore it may also be desirable to transmit over such a line D. C. Morse or telegraphic currents.

A common transmission line arranged for the multiplex transmission of currents for different purposes may often include apparatus which will readily transmit certain of the currents transmitted thereover but which will attenuate and extinguish other of said currents. Such a condition, for purposes of illustration, might arise in a two-wire line, including repeater apparatus, as the repeaters included in such a line might readily allow the transmission of the alternating currents utilized for telephonic or signaling purposes, but would not transmit the D. C. Morse or telegraph currents transmitted over such a line. Accordingly it is a general purpose of this invention to provide in a multiplex transmission system arrangements whereby certain of the currents transmitted over such a system may be transmitted around apparatus in such a system which would tend to attenuate or extinguish such currents. Another purpose or feature of the invention consists in providing arrangements which may be associated with a transmission line arranged for the one-way transmission of currents for different purposes such as telephonic or signaling currents, such arrangements allowing the one-way line to be utilized as a two-way transmission line for currents used for other purposes, such as for telegraphic purposes. A specific illustration of the above conditions would arise in connection with one of the two-wire, one-way lines of the well known four-wire transmission system which line might be arranged for one-way transmission of telephone and signaling currents and two-way transmission of telegraph currents. Other and further features and purposes of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description, taken in connection with the accompanying drawing, in which is illustrated a circuit diagram embodying a preferred form of the invention.

In the drawing is illustrated a transmission line including two sections, L_1 and L_2 interconnected by a translating device 6. For purposes of illustration, the translating device 6 has been shown as a one-way vacuum bulb repeater, and the transmission line may be a two-wire one-way portion of the well known four-wire type of transmission system, in which the line is arranged for the transmission of currents in one direction only. However, it is understood that the arrangements of the invention may equally well be associated with a transmission line arranged for the two-way transmission of currents. While the repeater 6 has been illustrated as of the vacuum bulb type, and is arranged to transmit currents coming in over the line L_1 out over the line L_2, it is understood that other types of repeaters such as the mechanical repeater or other types of translating devices might equally well be employed. The lines L_1 and L_2 terminate in the networks N_1 and N_2 respectively adapted to balance to the said lines. Included in line L_1 are the filters F_1 and F_2, and included in line L_2 are the filters F_3 and F_4. These filters may be of the type illustrated in the United States patents to G. A. Campbell, Nos. 1,227,113

and 1,227,114, and are adapted to readily transmit a band of frequencies suitable for purposes of telephoning or signaling, but which serve to attenuate and extinguish currents having frequencies outside of such range. Associated with line L_1 is a telegraph circuit including the windings of a polar relay 15 and the composite sets 14 and 16. Associated with the line L_2 is a telegraph circuit including the windings of a polarized relay 24 and the composite sets 25 and 26. The composite sets 14, 16, 25 and 26 are adapted to readily allow the transmission of currents suitable for telegraphic purposes, but which attenuate and practically extinguish currents of other frequencies. The polarized relay 15 is controlled by telegraphic currents coming in over line L_1, and controls the vibrating circuit 19. The vibrating circuit 19 is of a well known type and serves to give a reinforcing action to the energy coming in over line L_1, whereby the telegraphic currents coming in over line L_1 may be transmitted in re-enforced form from the circuit 19 over the circuit 21, 22. Included in this last mentioned circuit is a composite set 23 adapted to readily transmit current suitable for telegraphic purposes, but which attenuates and extinguishes currents of other frequencies. The circuit 21, 22 is bridged across the midpoints of the windings of the polarized relay 24. The polarized relay 24 is controlled by telegraphic currents coming in over the line L_2, and in turn controls the vibrating circuit 31. The vibrating circuit 31 is similar to circuit 19, and serves to give a re-enforcing action to the incoming energy whereby the telegraphic currents from line L_1 may be transmitted in re-enforced form from circuit 31 out over the circuit 32, 33. This last mentioned circuit includes the composite set 34, which is adapted to allow the transmission of current suitable for telegraphic purposes, but which attennuates, and practically extinguishes currents of other frequencies. The circuit 32, 33 is bridged across the midpoints of the windings of the polarized relay 15.

The operation of the invention is as follows: Alternating currents suitable for purposes of telephoning or signaling coming in over the line L_1 will be transmitted over the following circuit: from the line L. through the filter F_1, over conductors 1 and 2, through transformer 3 and over the input circuit 4, 5 of the repeater 6. These currents will then be transmitted in amplified form over the output circuit 7. 8, of the repeater, through transformer 9, over conductors 10 and 11 through the filter F_4 and out over the line L_2. These telephonic or signaling currents coming in over line L_1 will normally have no effect on the telegraphic circuit associated with line L_1, as they will not be transmitted to the windings of polarized relay 15, due to the fact that they will be attenuated and extinguished by the composite set 14. However, if any of these telephonic or signaling currents were of such a character that they might be transmitted through the filter 14 to the windings of relay 15 such currents would be opposed and neutralized in the windings of relay 15 by equal and opposite signaling or telephonic currents which would be transmitted over conductors 17 and 18 and through the composite set 16. Accordingly the telephonic or signaling currents coming in over line L_1 will not affect the telegraphic apparatus associated with said line. The telephonic or signaling currents transmitted from conductors 10 and 11 to the line L_2 will normally cause no disturbance in the telegraphic apparatus associated with said line due to the fact that such currents will be attenuated and extinguished by the composite sets 25 and 26. However, if any of such telephonic or signaling currents were of such a character that they would be transmitted from conductors 27 and 28 and through the composite set 26 to the windings of the polarized relay 24, such currents would be opposed and neutralized in said windings by an equal and opposite current transmitted over conductors 29 and 30, and through the composite set 25. Accordingly the telephonic or signaling currents applied to line L_2 will cause no interference with the telegraphic apparatus associated with said line.

Telegraphic currents may be transmitted from the line L_1 to the line L_2 in the following manner: Telegraphic currents applied to the line L_1 will be transmitted over conductors 12 and 13 through the composite set 14 and to the windings of the polarized relay 15, thereby actuating the relay 15. The polarity of these incoming telegraphic currents will determine the operation of the polar relay 15. The operation of the relay 15 in turn will control the circuit 19 whereby current of either polarity may be applied from the battery B, or the battery B_2, to the outgoing circuit 21, 22. This last mentioned current being applied to the midpoints of the windings of polarized relay 24 will not affect the relay 24, and these currents will be applied through composite set 26 and over conductors 27 and 28 and out over the line L_2. It is pointed out that these telegraphic currents coming in over line L_1 will not affect the repeater 6, as they will be attenuated and practically extinguished by the filters F_1 and F_2. Furthermore, the telegraphic currents applied from conductors 27 and 28 to the line L_2 will not interfere with the repeater apparatus, as they will be attenuated and practically extinguished by the filters F_3 and F_4.

Telegraphic currents may be transmitted from the line L_2 to the line L_1 in the following manner: Telegraphic currents will be transmitted from line L_2 over conductors 27 and 28 through the composite set 26 and thence through the windings of the polarized relay 24. The polarity of these incoming currents will determine the operation of relay 24 which in turn will control the operation of the vibrating circuit 31, whereby current from the batteries B_3 and B_4 of either polarity may be transmitted over the output circuit 32, 33. As the output circuit 32, 33 is bridged across the midpoints of the windings of polarized relay 15 these telegraphic currents will cause no disturbance or operation of relay 15. These telegraphic currents will then be transmitted through the composite set 14 and over conductors 12 and 13 and out over the line L_1. These last mentioned telegraphic currents applied from conductors 12 and 13 to the line L_1 will not interfere with the repeater 6, as they will be attenuated and practically extinguished by the filter F_1. However, if these telegraphic currents were not effectually attenuated and extinguished by filter F_1, and a portion of said currents were transmitted through the filter F_1, these last mentioned currents would be opposed and neutralized at points 36 and 37 by equal and opposite currents transmitted from conductors 32 and 33 over conductors 17 and 18 and through the filter F_2. Accordingly the telegraphic currents transmitted from line L_2 to line L_1 will cause no interference with the telephonic or signaling apparatus of the system. The composite devices 23 and 34 included in the telegraph circuits are provided to shut out any surges of the Morse currents for vibrating circuits 19 and 31, which might be within the signaling or telephonic range.

While the invention has been disclosed in certain specific arrangements which have been deemed desirable, it is understood that the arrangements of the invention in general provide a means whereby two-way transmission of certain types of currents may be obtained over a transmission line which is arranged for only one-way transmission of other types of currents. Accordingly the arrangements of the inventions are capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A transmission line upon which are superimposed alternating signaling currents and direct telegraph currents, said line comprising two line sections interconnected by a signaling circuit bridged across each of said line sections and including a translating device arranged to transmit only said alternating signaling currents, a telegraph circuit interconnecting said line sections, said telegraph circuit comprising a balanced four-wire circuit including relays each provided with two line windings, windings of said relays being bridged across each of said line sections on each side of said bridged signaling circuit connection, and means for preventing said signaling currents from being transmitted over said telegraph circuit.

2. A transmission line upon which are superimposed alternating signaling currents and direct telegraph currents, said line comprising two line sections interconnected by a signaling circuit bridged across each of said line sections and including a translating device arranged to transmit only said alternating signaling currents, filters in said line sections for preventing telegraph currents from being transmitted over said bridged signaling circuit, a telegraph circuit interconnecting said line sections, said telegraph circuit comprising a balanced four-wire circuit having two two-wire circuits and relays each provided with two line windings, telegraph repeaters in each of said two-wire circuits, windings of said relays being bridged across each of said line sections on each side of said bridged signaling circuit connection, and means for preventing said signaling currents from being transmitted over said telegraph circuit.

In testimony whereof, I have signed my name to this specification this 25th day of September, 1919.

LLOYD ESPENSCHIED.