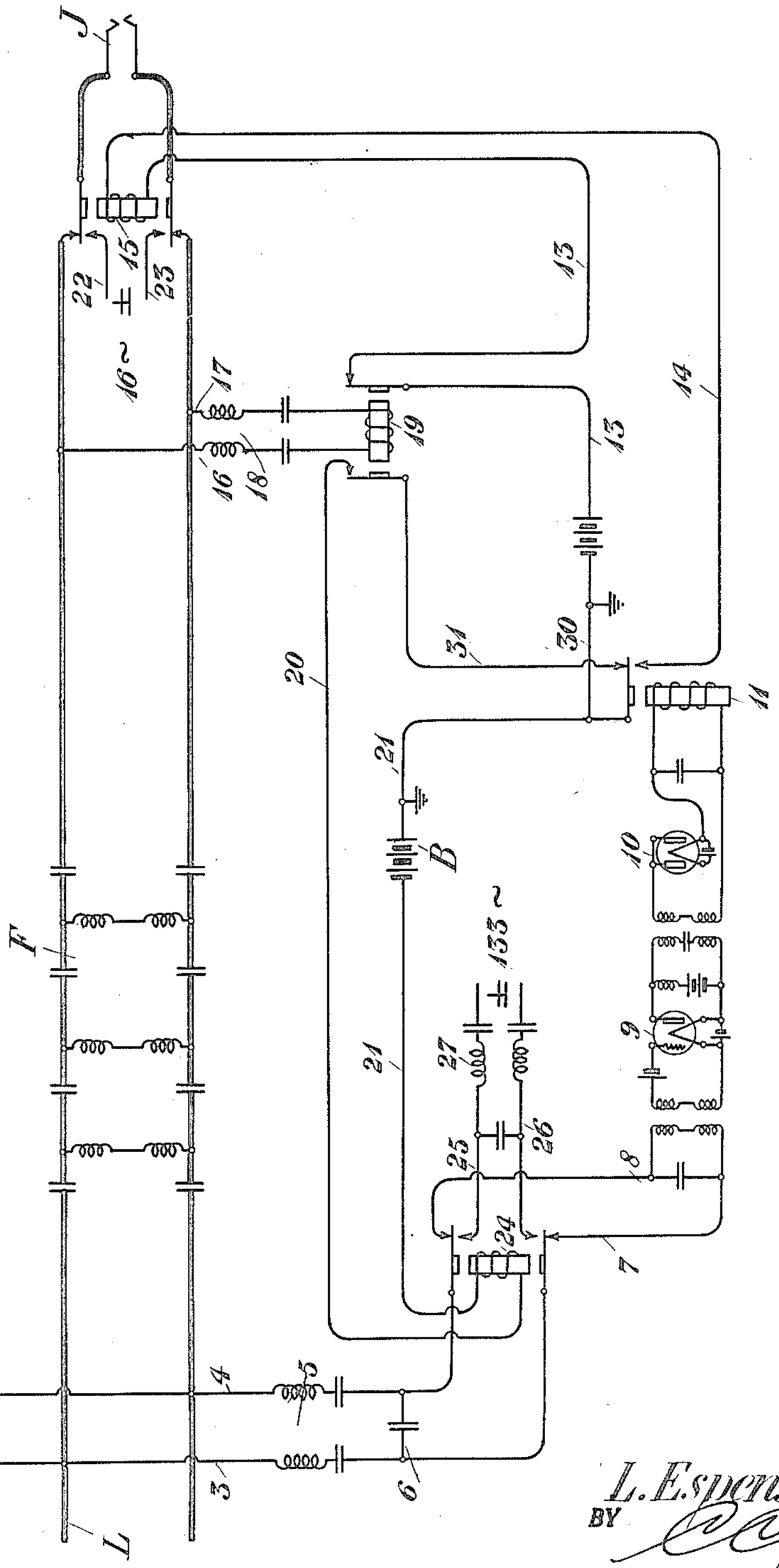
Apr. 17, 1923. 1,451,767

L. ESPENSCHIED

COMPOSITE RINGER FOR MULTIPLEX TRANSMISSION SYSTEMS

Filed Sept. 27, 1919



INVENTOR.
L. Espenschied
BY
ATTORNEY.

Patented Apr. 17, 1923. 1,451,767

UNITED STATES PATENT OFFICE.

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

COMPOSITE RINGER FOR MULTIPLEX-TRANSMISSION SYSTEMS.

Application filed September 27, 1919. Serial No. 326,738.

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 Composite Ringers for Multiplex-Transmission Systems, of which the following is a specification.

This invention relates to transmission lines arranged for the multiplex transmission of a plurality of currents.

Multiplex transmission may be secured over a common transmission line by superposing on such a line a plurality of carrier frequencies, the carrier frequencies being separated sufficiently to prevent interference and each frequency being assigned for use as a separate channel of communication. Telephonic variations may be impressed on certain of said carrier frequencies, while other of said carrier channels might be utilized for ringing or signaling purposes. Furthermore telegraphic or Morse impulses might also be transmitted over the common transmission line. At the terminal arrangements of such a line or at other points suitable selective circuits may be associated with the line to separate the various carrier channels and divert the currents into separate circuits.

It has been the practice to utilize as a carrier channel for signaling purposes an alternating current of a frequency in the neighborhood of approximately 133 cycles. Signaling current of approximately this frequency has been utilized so that the signaling currents would not interfere with the telegraphic apparatus associated with the line, the selective circuits associated with the telegraph apparatus being adapted to transmit the Morse impulses which might have a frequency from 0 to approximately 60 cycles and to attenuate and extinguish currents of higher frequencies, such as that of the signaling currents. However the signaling apparatus associated with such a line, such as at a switchboard, is adapted to operate with currents having frequencies in the neighborhood of 16 cycles. Such currents would interfere with the telegraph apparatus, if they were transmitted over the line as they would be within the telegraphic frequency range and would not be extinguished by the selective circuit associated with the telegraph apparatus. Accordingly means must be provided for changing the incoming 133 cycle signaling current transmitted over the line into 16 cycle current so that it will properly operate the signaling apparatus at the switchboard, and the 16 cycle current transmitted out from the switchboard must be changed into 133 cycle current before being transmitted out over the transmission line. A device accomplishing these purposes is commonly termed a composite ringer.

Accordingly it is the general purpose of this invention to provide an improved form of composite ringer, which may be associated with a transmission line arranged for the multiplex transmission of a plurality of carrier frequencies, and which will provide an improved arrangement of selective circuits whereby interference between the various currents transmitted over the line may be eliminated. A further feature consists in providing arrangements whereby better transmission may be secured for the signaling currents utilized. 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 in connection with the accompanying drawing in the figure of which is illustrated a circuit diagram embodying a preferred arrangement of the invention.

In the drawing is illustrated the incoming portion of a transmission line L upon which may be superposed a plurality of different currents for purposes such as telephoning, signaling, or telegraphing. Line L is shown as terminating in the jack J with which might be associated apparatus running to a switchboard. Bridged across line L is the telegraph circuit 1 whereby the telegraphic impulses coming in over line L may be transmitted to suitable telegraph apparatus, or whereby telegraphic impulses may be applied to line L for transmission thereover. Included in the telegraph circuit 1 is the composite set 2 which readily allows the transmission of currents suitable for telegraphic purposes but which attenuates and practically extinguishes currents of other frequencies. Included in line L between the telegraph conductors 1 and jack J is the filter F, commonly termed a "high pass" filter, and adapted to readily allow the transmission of currents having rela-

tively high frequency, such as telephonic currents, but which attenuates and extinguishes currents of frequencies below the telephonic range, such as signaling or telegraphic currents. The filter F may be of the type illustrated in U. S. Patents No. 1227113, No. 1227114, granted to G. A. Campbell. .Bridged across line L on the line side of filter F are conductors 3 and 4 of the composite ringer. Included in conductors 3 and 4 is an arrangement 5 of inductance and capacity which makes the circuit resonant to the currents suitable for signaling over line L, such as 133 cycle currents, and accordingly the circuit will readily allow the transmiss on of such currents but will attenuate and practically extinguish currents of other frequencies. Bridged across conductors 3 and 4 is the condenser 6 of large capacity which serves as a shunt for any currents of relatively high frequency, such as telephonic currents, which might be transmitted through the device 5. Normally connected to the circuit 3, 4, is the circuit 7, 8, with which is associated the amplifier 9 and the rectifier 10 whereby the signaling currents coming in over line L may be reinforced and rectified so as to operate the direct current relay 11. The relay 11 controls circuit 13, 14, in which is included relay 15. The relay 15 operates to apply ringing current of a frequency in the neighborhood of 16 cycles to a portion of line L connected to jack J. Bridged across line L between filter F and jack J is the circuit 16, 17 of the composite ringer. This circuit includes an arrangement 18 of inductance and capacitv whereby the circuit is tuned to be resonant to the signaling currents transmitted from the switchboard, such for example as 16 cycle currents. Accordingly the circuit will readily transmit signaling currents of the order last mentioned but will attenuate and practically extinguish currents of other frequencies. Included in circuit 16, 17 is relay 19 which is actuated by these 16 cycle signaling currents. Relay 19 controls circuit 20, 21, which in turn controls relay 24. The operation of relay 24 serves to disconnect circuit 7, 8 from circuit 3, 4, and to connect to circuit 3, 4, a source of current suitable for signaling out over line L, such as 133 cycle current.

The operation of the invention is as follows. Signaling currents coming on over the line L will not be transmitted over the telegraph circuit 1 or to the telephone apparatus associated with line L as they will be attenuated and practically extinguished by the filter F and the composite set 2. These signaling currents, which may be in the neighborhood of 133 cycle current, will be transmitted over the circuit 3 and 4 as this circuit is tuned by the device 5 to be resonant to currents of such frequency. These signaling currents will then be transmitted over the armature and normal contacts of relay 24 and over circuit 7, 8, to the amplifier 9, and thence in amplified form to the rectifier 10, and thence about the winding of direct current relay 11, and will operate relay 11. The direct current relay 11 and the ampl fier 9 and rectifier 10 are provided in the composite set for the following purposes. When an alternating current carrier channel is superposed on the line L for purposes of signaling, it is necessary in order to prevent harmonics of this signaling current from interfering with the carrier channel superposed on the l ne for telephonic purposes, to so limit the signaling current so as to render it impossible to operate the usual type of alternating current relay directly from the signaling current transmitted over the line. Accordingly the provision of a signaling receiv ng circuit including the amplifier 9, the rectifier 10, and the direct current relay 11, makes it possible to further prevent interference between the carrier channels superposed on Line L, as such arrangements may be operated by a desirable type of signaling current which will not interfere with the other carrier channels. The operat on of relay 11 closes the following circuit; from battery B, conductor 13, armature and contact relay 19, conductor 13, winding of relay 15, conductor 14, make contact and armature of relay 11, conductor 30, to ground. The closing of this circuit will operate relay 15 which will connect to the line L_1 the conductors 22 and 23 leading to a source of 16 cycle current. Signaling current of a frequency in the neighborhood of 16 cycles will then be appl ed over the line L and the contacts of jack J to signaling apparatus in a circuit associated with the incoming end of line L.

If it is desired to transmit signaling current out over the line L, signaling current of approximately 16 cycles will be transmitted from apparatus, such as switchboard apparatus associated with jack J, over line L, and thence over conductors 16, 17, through the device 18, and about the windings of relay 19. This signaling current will not be transmitted over line L beyond filter F as it will be attenuated and practically extinguished thereby. However the signaling current will be readily transmitted over circuit 16, 17, as this circuit is tuned by device 18 to be resonant to these signaling currents of approximately 16 cycles. As this circuit is resonant to these signaling currents it will prevent any telephonic currents from being transmitted thereover. These signaling currents will operate relay 19. The operation of relay 19 closes the following circuit; from battery B, conductor 21, winding of relay 24, conductor 20,

left hand contact and armature of relay 19, conductor 31, normal contact and armature of relay 11, conductor 21, to ground. The closing of this circuit will operate relay 24, which will disconnect circuit 3, 4, from conductors 7 and 8 and will connect circuit 3, 4, to conductors 25 and 26. The conductors 25 and 26 are connected to a source of current for signaling out over line L, such as current of a frequency in the neighborhood of 133 cycles. Accordingly upon the operation of relay 24 signaling current of approximately 133 cycles will be applied to circuits 3, 4, and thence out over line L. It is pointed out that when signaling current is being transmitted from line L through the composite ringer to the apparatus associated with jack J and the relay 11 has been operated by the incoming signaling current, the relay 11 will serve to hold open the previously traced circuit for relay 24. Furthermore when signaling current is being transmitted from apparatus associated with jack J out over line L and the relay 19 has operated the relay 19, will hold open at its right hand contact the previously traced circuit for relay 15. Accordingly means are provided whereby signaling current may be transmitted through the composite ringer only in one direction at the same time and the possibility of interference between signaling currents is eliminated.

The including of the high pass filter F in the line L between conductors 3, 4, of the 133 cycle branch of the composite ringer and conductors 16, 17, of the 16 cycle branch of the composite ringer serves to prevent false operation of the 16 cycle branch of the composite ringer. Such false operation might otherwise be caused by surges of the Morse or telegraphic currents either incoming over line L or transmitted to line L from circuit 1. These surges of Morse current might in some instances be of a frequency which might be transmitted through device 18 in circuit 16, 17 and thus operate relay 19. However such surges of current would be effectually attenuated by filter F.

In former arrangements of composite ringer sets it has been the practice to include the composite set 2 associated with the telegraph circuit directly in the line L, rather than including it in a bridge across the line as in this invention. Accordingly in former arrangements the incoming or outgoing 133 cycle signaling currents had to be transmitted through the composite set. This telegraph composite set in order to exclude "Morse thump" from the telephone apparatus in the line had to have a relatively high cut-off frequency of the order of 200 to 300 cycles and therefore transmitted the 133 cycle signaling currents poorly. In the arrangements of the invention herein illustrated the 133 cycle signaling current does not have to pass through the telegraph composite set but goes from the output circuit of the ringer directly over the line L. In other words the output circuit of the ringer is associated with the line L at such a point that the telephonic and telegraphic selectivity circuits will be on the terminal or drop side of the line with respect to such output circuit. As the "Morse thump" will not affect the signaling apparatus associated with the line as seriously as the telephone apparatus, the selective circuit in the output circuit of the ringer may be designed to have a lower cut-off frequency than the telegraph composite sets of former arrangements and accordingly better transmission of the 133 cycle signaling currents may be provided.

While reference has been made to signaling currents having frequencies in the neighborhood of 133 cycles or in the neighborhood of 16 cycles it is understood that the signaling currents utilized are not specifically limited to currents of these frequencies, these frequencies having been mentioned for purposes of illustrating the principles of the invention merely, and that signaling currents of other frequencies may be used. Furthermore while the invention has been disclosed as embodied in certain specific arrangements which have been deemed desirable it is understood that they 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 arranged for the multiplex transmission of currents for purposes of telephoning, telegraphing, and signaling, a composite ringer device including a relatively high frequency circuit and a relatively low frequency circuit, said circuits being associated with said transmission line, and selective arrangements for said telephone currents and said telegraph currents, said selective arrangements for said telephone currents being associated with said transmission line on the terminal side thereof with respect to said relatively high frequency circuit of said composite ringer, and said selective arrangements for said telegraph currents being included in a bridge across said transmission line.

2. A transmission line arranged for the multiplex transmission of currents for purposes of telephoning and signaling, a composite ringer including a circuit transmitting relatively high frequency signaling currents and a circuit transmitting relatively low frequency signaling currents, said two last mentioned circuits being associated with said transmission line, and a filter in said line between said two last mentioned circuits, said filter being adapted to allow the trans-

mission of currents for telephone purposes but which extinguishes currents of other frequencies.

3. A transmission line arranged for the multiplex transmission of currents for purposes of telephoning, signaling, and telegraphing, a composite ringer including a circuit transmitting relatively high frequency signaling currents and a circuit transmitting relatively low frequency signaling currents, said two last mentioned circuits being associated with said transmission line, a filter in said line between said two last mentioned circuits, said filter being adapted to readily allow the transmission of currents of telephonic frequencies but which attenuates and extinguishes currents of other frequencies, a telegraph circuit bridged across said transmission line as the incoming side of said line with respect to said filter, and a composite set in said telegraph circuit.

4. A transmission line arranged for the multiplex transmission of currents for purposes of telephoning, telegraphing, and signaling, said transmission line comprising two line sections interconnected by a filter said filter being adapted to readily transmit said telephone currents but which attenuates and practically extinguishes said other currents, a composite ringer including a circuit transmitting relatively high frequency signaling currents and a circuit transmitting relatively low frequency signaling currents, one of said last mentioned circuits being bridged across one of said line sections and the other of said circuits being bridged across the other of said line sections, means in the high frequency signaling circuit of said composite ringer for making said circuit resonant to signaling currents suitable for transmission over the line section associated therewith, means in the low frequency signaling circuit of said composite ringer for making said circuit resonant to signaling currents suitable for transmission over the line section associated therewith, a telegraph, circuit bridged across the line section with which said high frequency signaling circuit is associated, and a composite set in said telegraph circuit.

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

LLOYD ESPENSCHIED.