

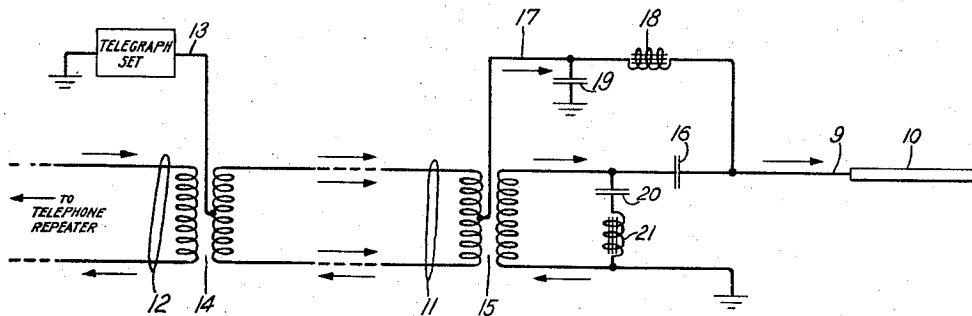
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TELEPHONE AND TELEGRAPH SIGNALING SYSTEM

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TELEPHONE AND TELEGRAPH SIGNALING SYSTEM

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The present invention relates to improvements in signaling circuits and more particularly to a link or coupling between a land line and a submarine signaling cable where the line and the cable are to be used for the simultaneous transmission of telephone and telegraph messages.

An object of the invention is to provide a connection of the kind mentioned which comprises a repeating coil of the proper ratio to match the telephone frequency impedances and to act as a direct conductor for the telegraph currents.

A feature of the invention is a filter inserted between the mid-point of one of the windings of a repeating coil and a submarine cable terminal for the purpose of rounding off the wave shape of the telegraph impulses so that they will not interfere with the efficiency of the telephone transmission.

In the development of composited lines composed of one or more sections of land lines and one or more sections of submarine cable, it has been found desirable to be able to use a connection for coupling between the submarine cable section and the land line section which permits of the insertion of a proper ratio repeating coil to match the impedances at telephone frequencies and to act as a direct conductor for the telegraph currents.

The present invention solves this problem in the following manner: The two-conductor land line is operated in simplex and is connected to the cable by means of a repeating coil or transformer of the proper ratio to match the impedances of the land line and cable respectively. The circuit comprises a low pass filter in the form of coils and condensers of suitable value, allowing only frequencies up to about 80 to 100 cycles per second to pass, inserted between the middle of the repeating coil winding which is connected to the land line and the submarine cable terminal. Thus the path of the telegraph currents is over the land line in parallel, passing differentially through the repeating coil and consequently having no action thereupon, thence through a retardation coil to the single conductor of the sub-

marine cable. Associated with the retardation coil are three condensers and a choke coil whose function it is to so round off the wave shape of the telegraph impulses that they will not produce, through the winding of the repeating coil which leads to the telephone repeater, disturbing currents of sufficient magnitude to be transmitted through the coil and over the land line to the telephone repeater. The path of the telephone currents from the telephone repeater is through a transformer serially over the land line and through the primary winding of the repeating coil to the secondary winding thereof. One side of the secondary winding of the repeating coil is grounded and the other side is connected through a condenser to the submarine cable.

In the accompanying drawing, wherein one embodiment of the invention is illustrated, a submarine cable 10 is adapted to receive a composite arrangement of telephone and telegraph messages from a two conductor land line 11, over a single conductor 9. The land line transmits, in a simplex arrangement, telephone currents received from a source 12 and telegraph signals from another source 13.

The telephone paths 12 and 11 comprises a two-wire circuit connected to any suitable source such as a telephone repeater (not shown). The sections 12 and 11 are insulated from each other by means of a repeating coil or transformer 14. Conductor 13, for telegraph impulses, is connected to the mid-point of the secondary winding of transformer 14.

At the cable terminal of the land line, the latter is connected to the primary winding of another repeating coil or transformer 15. The secondary winding is grounded at one end and has its opposite end connected, by means of conductor 9, through a condenser 16 to cable 10. In order to transmit a maximum of power without producing reflection effects, the latter repeating coil is constructed with such a ratio as to match the impedances of the land line and cable respectively, at telephone frequencies. That is to say, at ordinary telephone frequencies, the impedance

of the primary winding is equal to the impedance of the land line, while the impedance of the secondary winding is equal to that of the submarine cable 10.

5 The value of the condenser 16 may be selected to be such that it will have a compensating effect, at ordinary telephone frequencies, for the differences in the attenuation of telephone currents over the submarine cable.

10 The telegraph impulses are conducted from the primary winding of repeating coil 15 to the cable by means of a path 17 connected at one end to the mid-point of the land side winding of the repeating coil, and at the

15 other end to cable 10. This path comprises a retardation coil 18 in series and a grounded condenser 19 in parallel. The function of the condenser 19 and coil 18 is to act as a low-pass filter for rounding off the wave shape of the

20 telegraph impulses so they will not interfere with the telephone transmission. Accordingly, their values should be selected so that they will permit passage of impulses to the conductor 9 of telegraph frequencies up to about

25 80 or 100 cycles per second with small or negligible attenuation.

Another filter comprising a condenser 20 and a retardation coil 21 in series, is grounded at one end and connected at its opposite end to conductor 9, between the repeating coil 15 and condenser 16. The values of the condenser 20 and coil 21 may be selected to permit the passage therethrough of currents of

30 low frequency as used in telegraph communication.

At the opposite end of the submarine cable, similar equipment (not shown) to that described above may be employed to complete the circuit.

40 *Operation*

The telephone messages are received by the primary winding of transformer 14 and transferred thereby to the two-conductor land

45 line and thence to the primary winding of repeating coil 15. The secondary winding of the latter forms a series circuit with the condenser 16, cable 10, equipment at the opposite end of the cable 10 and return through

50 ground.

The telegraph signals from source 13 pass differentially through the secondary winding of transformer 14, in parallel paths along the land line 11 and differentially through

55 the primary winding of repeating coil 15 to the branch 17. By passing differentially through the windings of the coils 14 and 15, the telegraph signals produce a negligibly small inductive effect upon the telephone currents. Condenser 19 and retardation coil 18

60 filter the high frequency components of the telegraph signals, so that they will not interfere with the telephone communication. The telegraph currents from the branch 17

65 pass through the cable 10 to the distant end.

The higher frequency components of the telegraph currents, however, pass through condenser 16 and are drained off to ground by the low pass filter comprising coil 21 and condenser 19.

Although, for the purpose of illustration, a description only of the paths taken by messages transmitted to the cable has been given, it is clear that the apparatus described is adapted to receive signals in composite arrangement from the cable and repeat them to their proper channels. The course taken by the received impulses will be obvious from the above description and no further explanation is deemed necessary.

What is claimed is:

1. A signaling system comprising in combination, a two-wire line, means for transmitting over said line messages of one frequency as a two-wire circuit, and messages of another frequency over both sides of said line in parallel, a second line connected in circuit with said two-wire line, and means for transmitting both of said messages over a single conductor included in said second line.
2. A system comprising a ground return cable circuit and a two-wire land line circuit in combination with means whereby telephone currents transmitted over the land line as a two-wire circuit are transmitted over the cable as a one-wire circuit with a ground return, and means whereby telegraph currents are transmitted over both sides of the land line circuit in series with the cable circuit as a one-wire circuit with ground return.
3. In a signaling system, the combination of a two-wire line, connected by means of a transformer to a single conductor, said line, transformer and conductor being adapted for the transmission of currents of telephone frequencies, and a path from the mid-point of the line side of said transformer to a point on said conductor for the transmission over said single conductor of currents of telegraph frequencies.
4. In a signaling system, the combination of a two-wire line, connected by means of a transformer to a single conductor, said line, transformer and single conductor being adapted for the transmission of currents of telephone frequencies, a path from the mid-point of the line side of said transformer to a point on said single conductor for the transmission over said single conductor of currents of telegraph frequencies, and means to prevent currents of telegraph frequencies from passing through the other side of said transformer.
5. A signaling system in accordance with claim 4, in which said means comprises a condenser in series with said single conductor and transformer and in parallel with said path and adapted to permit passage therethrough of currents of telephone frequencies.

6. A circuit for connecting a two-wire land line circuit to a ground return cable circuit comprising a transformer coupling the land line circuit to the cable circuit for telephone frequencies, and a path from the mid-point of the line side of said transformer to a point on said cable circuit for transmitting telegraph currents over said cable, said path including series inductance and shunt capacity.

7. A circuit in accordance with claim 6 in which between the cable side of said transformer and said point on said cable circuit there is connected means for selectively transmitting telephone currents from the transformer to the cable and selectively suppressing telegraph currents tending to pass from said transformer to said cable.

8. In a signaling system, a telephone circuit comprising a two-wire land line connected to a single conductor cable by means of a repeating coil, said land line, repeating coil and cable being adapted to transmit currents of telegraph frequency, a transformer interposed in said land line, a telegraph circuit comprising a line adapted to transmit current of telegraph frequency and connected to the mid-point of the cable side of said transformer, and a path for said telegraph current between the mid-point of the land line side of the repeating coil and a point on said cable for the transmission over said cable of said telegraph currents.

9. In a signaling system, a telephone circuit comprising a two-wire land line connected to a single conductor cable by means of a repeating coil, a transformer interposed in said land line, a telegraph circuit comprising a line adapted to transmit current of telegraph frequency and connected to the mid-point of the cable side of said transformer, a path for said telegraph current between the mid-point of the land line side of the repeating coil and a point on said cable, and a condenser in series with said cable and repeating coil and in parallel with said path, said condenser being adapted to permit passage therethrough of currents of telephone frequency.

10. In a signaling system, a telephone circuit comprising a two-wire land line connected to a single conductor cable by means of a repeating coil, said land line, repeating coil and cable being adapted to transmit currents of telegraph frequency, a transformer interposed in said land line, a telegraph circuit comprising a line adapted to transmit current of telegraph frequency and connected to the mid-point of the cable side of said transformer, a path for said telegraph current between the mid-point of the land line side of the repeating coil and the cable, and a low pass filter connected to said cable in parallel with the repeating coil to prevent currents of telegraph frequency from

passing through the cable side of said repeating coil.

11. In a signaling system, the combination of a two-wire land line, connected by means of a transformer to a ground return cable circuit, said land line, transformer and cable circuit being adapted for the transmission of currents of telephone frequencies, and a path from the mid-point of the line side of said transformer to the cable for the transmission over said cable of currents of telegraph frequencies, said path including a low pass filter, the impedances of the respective windings of said transformer at telephone frequencies being such as to match the impedances of the land line and cable circuit respectively.

In witness whereof, I hereunto subscribe my name this 4th day of March, 1929.

GEORGE C. CUMMINGS.