

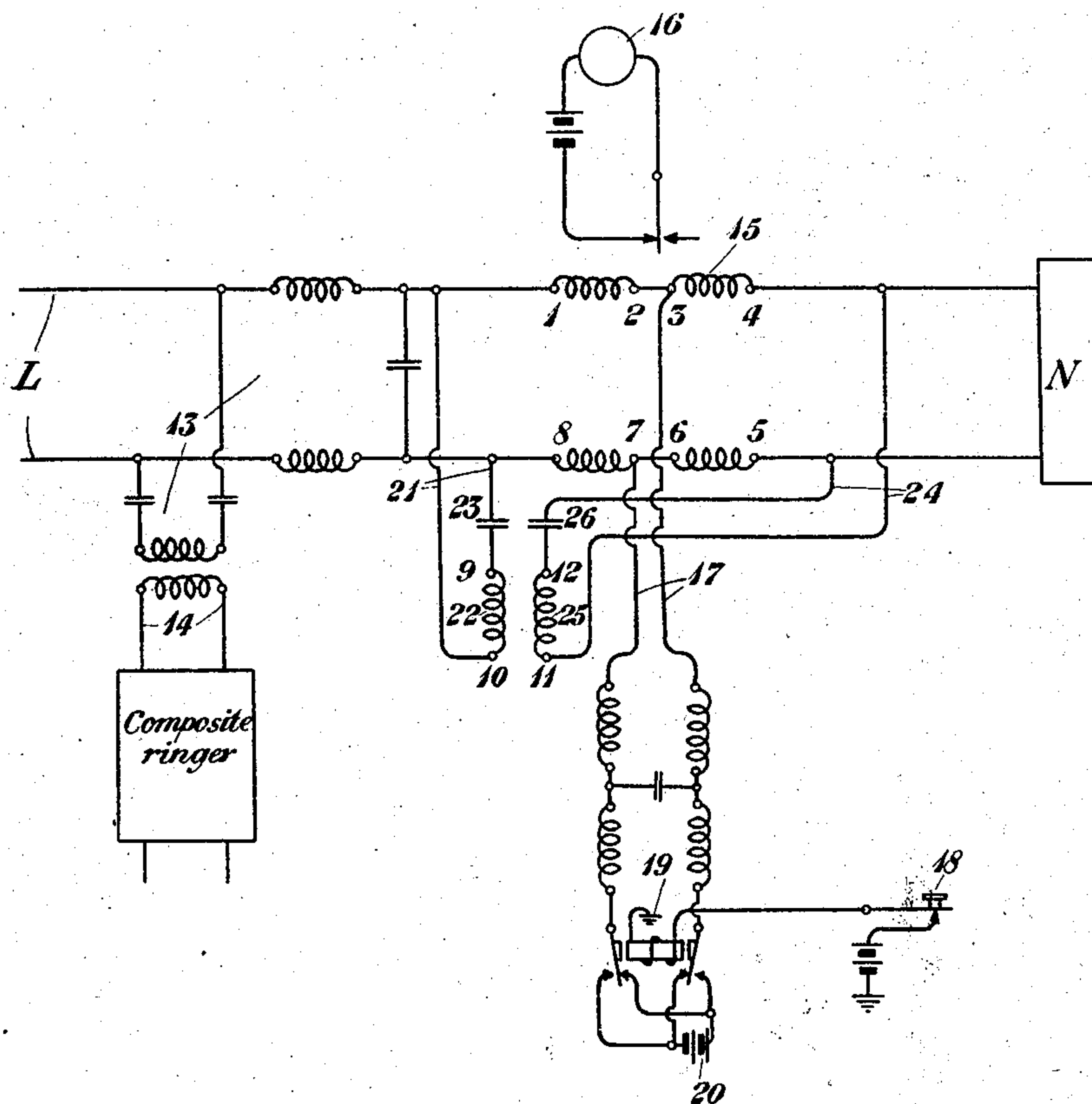
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COMBINED RESONANT SHUNT DEVICE FOR TELEGRAPH CIRCUITS

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BY

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COMBINED RESONANT SHUNT DEVICE FOR TELEGRAPH CIRCUITS.

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This invention relates to transmission lines and more particularly to arrangements for preventing interference between different types of currents utilized on such lines.

5 When a transmission line is composited for both telegraph, telephone and signaling purposes it is necessary to make special provision to prevent interference from the outgoing signaling current and the receiving telegraph relay. Ordinarily this might be accomplished by connecting a resonant shunt across the line between the composite set and the relay windings and a similar shunt across the line between the relay windings and balancing apparatus for purposes of balance. 15 It has been found in practice that such separate shunts are open to the objections that the coils have an undesirable reaction on the outgoing telegraph wave and furthermore increase equipment costs as two separate coils are required. In the arrangements of this invention the above objections and disadvantages are overcome and interference between the different currents and apparatus is prevented by utilizing a combined resonant shunt connected across the circuit on each side of the telegraph relay and having a single coil with two windings and with the elements of the shunt arranged and proportioned as pointed out hereinafter. Other features of the invention will appear more fully from the detailed description hereinafter given. 25 30

35 The invention may be more fully understood from the following description together with the accompanying drawing in which is illustrated a circuit diagram of the invention.

40 In the drawing is shown a portion of a transmission line L terminating in a composite set 13. Associated with the composite set is a circuit 14 which might be connected with a composite ringer including a source of signaling current, such for example as 135 $\sim$ current, which is suitable for transmission out over the line L. Associated with the composite set is a telegraph circuit which includes the windings of a telegraph relay 15. The terminals of the windings of relay 15 are numbered 1 to 8 inclusive. 50 These windings are supposed to be arranged so that current from an odd to an even terminal produces magnetization of the same kind. The windings of relay 15 through its armature control the sounder 16 to indicate 55

the incoming telegraph impulses and may in addition control current transmitted over another line section. The network N is provided for purposes of balance. Bridged across the midpoints of the windings of relay 15 is the sending circuit 17 controlled by the relay 19 and key 18 whereby battery of opposite polarity may be connected to the line. To prevent the signaling currents from circuit 14 from interfering with the telegraph relay 15 there is bridged across the telegraph circuit on each side of the relay windings the combined resonant shunt of this invention. This shunt includes the circuit 21 and the circuit 24. Circuit 21 includes winding 22 and condenser 23. Circuit 24 includes winding 25 and condenser 26. These two windings are made up of an equal number of turns and comprise a single coil rather than separate coils as in former arrangements. 60 65 70 75 80 85 90 95 100 105 110 The terminals of the windings are numbered 9, 10, 11, and 12 as shown. The windings are poled as indicated by the numerals of these terminals. In other words current from an odd to an even terminal will produce magnetization of the same kind. The condensers 23 and 26 are chosen so as to be equal to each other and so that both condensers in series will resonate with both windings 22 and 25 in series aiding at the particular interfering frequency, such as in this instance the frequency of the signaling current illustrated as 135 $\sim$. Under these conditions the shunt will effectually prevent any of the signaling current from interfering with the telegraph relay. As far as the outgoing telegraph wave is concerned it will be apparent that it passes through the two windings 22 and 25 in such a way as to cause magnetic effects of opposite sign. Consequently there is no net magnetizing effect and the coil acts substantially with respect to outgoing currents as if short circuited. It is desirable that the coupling of the coil be made fairly close. Under these conditions the arrangements of the invention provide a coil which will have no deterrent effect on the outgoing telegraph wave and which at the same time will prevent the signaling current on the line from interfering with the telegraph relay.

While the invention has been disclosed in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other

widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

- 5 1. A transmission line including a composite set, a circuit associated with said line through said composite set and including a source of signaling current, a telegraph circuit associated with said line through said
10 composite set, relay windings in said telegraph circuit, means for applying outgoing telegraph current to the midpoints of said relay windings, and separate shunt circuits connected across said telegraph circuit on
15 each side of said relay windings, each of said shunt circuits comprising a winding and condenser connected in series therein whereby said shunt circuits will be resonant at the frequency of said signaling current, said
20 windings being mounted on a common core and being poled so that said outgoing telegraph currents will cause no net magnetization effect in said windings.
2. A transmission line including a composite set, a circuit associated with said line through said composite set and including a source of signaling current, a telegraph circuit associated with said line through said
25 composite set, relay windings in said telegraph circuit, means for applying outgoing telegraph current to the midpoints of said relay windings, and separate shunt circuits connected across said telegraph circuit on
30 each side of said relay windings, each of said shunt circuits comprising a winding and condenser connected in series therein whereby said shunt circuits will be resonant at the frequency of said signaling current, said
35 windings being mounted on a common core and being poled so that they will cause sub-

stantially no effect on said outgoing telegraph currents.

3. A transmission line, a balancing network, a transmitting means and a receiving means associated with said line, said transmitting and said receiving means being in conjugate relation, separate circuits bridged across said line on the line and network sides of said receiving means, each of said circuits comprising inductance and capacity
45 so arranged and so proportioned with respect to each other that said circuits will be resonant at a certain frequency coming in over said line and together will be substantially equivalent to a bridged capacity with respect to the currents transmitted to said
50 line from said transmitting means.

4. A transmission line including a composite set, a circuit associated with said line through said composite set and including a source of signaling current, a telegraph circuit associated with said line through said composite set, relay windings in said telegraph circuit, means for applying outgoing telegraph current to the midpoints of said
55 relay windings, and separate shunt circuits connected across said telegraph circuit on each side of said relay windings, each of said shunt circuits comprising a winding and condenser connected in series therein whereby said circuits will be resonant at the frequency of said signaling current, said windings being mounted on a common core and being so arranged that the magnetic effects produced therein by said outgoing telegraph
60 currents will be of opposite sign.

In testimony whereof, I have signed my name to this specification this 26th day of June, 1923.

HARRY NYQUIST.