

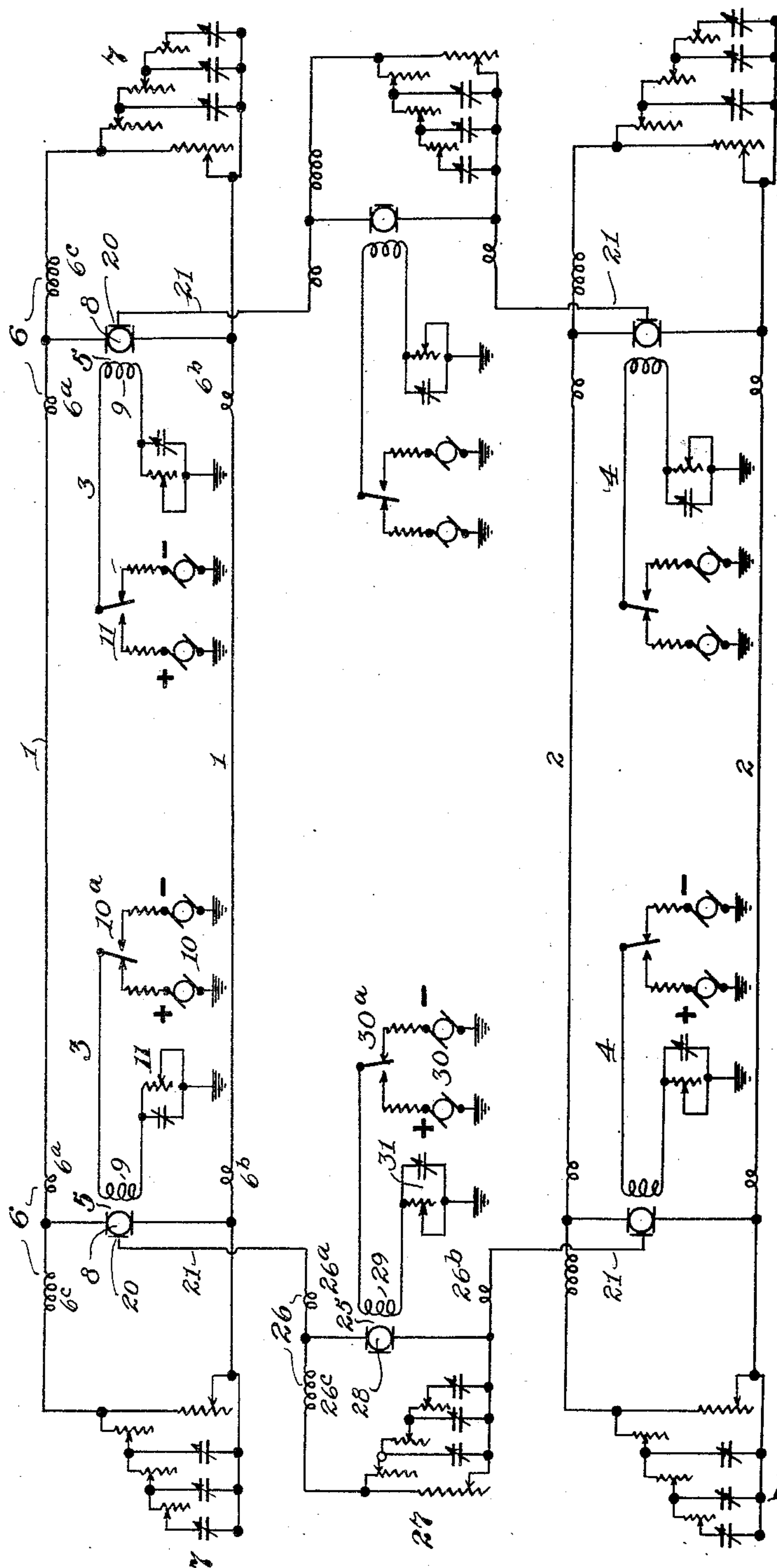
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SUPERPOSED TELEGRAPH SYSTEM

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SUPERPOSED TELEGRAPH SYSTEM

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This invention relates to telegraph systems adapted for polar signalling by reversal of the field of a generator, and particularly to a superposed telegraph system and a method of associating the superposed circuit and the circuits upon which it is superposed, through the armatures of the generators.

An object of the invention is the provision of suitably balanced circuits for the purpose of superposing an additional circuit thereon by means of taps at the electrical centers of the armature circuits of the generators.

Another object of the invention is to provide successful operation of the system at high speeds by the use of signal shaping networks designed to control the amount and direction of the current through the field windings of the generators.

The invention will be explained more fully in connection with the attached drawing which represents a superposed telegraph system embodying the features of the invention.

In the figure the line conductors 1, 1 and 2, 2 are provided, respectively, with terminal sets, represented generally at 3 and 4, at both ends of the line, by means of which two-way signalling over metallic circuits may be accomplished in the usual manner. Each terminal set comprises a transmitting generator 5 of special design, and a receiver or receiving polar relay 6 having coils 6a and 6b in the conductors of the metallic circuit, and a coil 6c in a conductor leading to the artificial line 7. The coils of the relay operate an armature, not shown, in the usual manner. The armature of the generator 5 is connected to the junction of coils 6a and 6c of the receiving relay, and to the junction of the coil 6b and the artificial line 7.

According to this invention the generator 5 is designed to provide for polar signalling by reversing its field, the armature 8 being connected to the line to supply thereto a voltage which will depend upon the direction and amount of current in the field winding 9. The field winding 9 is supplied from a source of potential 10 diagrammatically represented as applying impulses of opposite plurality

to the winding 9 by way of the tongue and contacts of the usual transmitter 10a.

If the capacity and resistance of the line circuit 1, 1 are large, the distortion factor of the circuit will be high. A line circuit of this type attenuates signals in proportion to their frequency, that is, the higher the frequency, the greater the line attenuation. The result is, that, viewed from the receiving end of the circuit, the apparent impedance increases with the frequency of the transmitted signals. The result of this unequal attenuation is that short signals, i. e. high frequency following the long low frequency pulses of the opposite polarity, are so badly distorted that relay at the receiving end will not respond to them.

In order to control the amount and direction of the current through field winding 9 and to compensate for the unequal attenuation with frequency, there is provided in the circuit of the source 10, a signal shaping network 11 which is shown as an adjustable condenser, shunted by an adjustable resistance, in series with the field winding 9 of generator 5.

By proper adjustment of the valves of the condenser and resistance, the current through the field and hence the voltage across the armature which controls the current sent to the line can be made to vary directly with the frequency of the transmitted signal. Thus the peak line input on the high frequency signals can be increased to compensate for the attenuation of the line.

The transmitting and receiving apparatus for terminal set 3 at the distant end of the line comprising conductors 1, 1 may be identical with that just described. Similarly, the apparatus making up terminal sets 4, 4 which are adapted to provide two-way communication over the metallic or "side" circuits including line conductors 2, 2 may be identical with that of terminal sets 3, 3.

In order that a circuit may be superposed on line conductors 1, 1 and 2, 2 the generator 5 of each side circuit terminal set, is provided with a tap 20 formed by a brush at the electrical center of its armature circuit. The superposed circuit apparatus is connected to

these brushes constituting the center taps by conductors 21. The superposed circuit sets may be identical with the terminal sets 3, 3 and 4, 4; that is, the transmitter may comprise a generator 25 having its armature 28 connected across conductors 21 and its field winding 29 supplied with impulses of opposite polarity from a source 30 through the tongue and contacts of the transmitter 30a and by way of a signal shaping network 31. As in the case of the side circuits, the receiver may comprise line conductor coils 26a, 26b and an artificial line conductor coil 26c.

Current from the superposed circuit passes to the side circuits by way of conductors 21 and the armatures 8 of the generators of the side circuit apparatus. The current in conductor 2 will split at the center 20 of the armature and half the current will pass through the armature in each direction. Thus no flux will be set up in the armature tending to generate signals on the circuits on which the superposing is done. Likewise the current from the superposed circuits will pass through the relay coils 6a, 6b in series with the line conductors, in a direction such that no flux will be set up in the relays, and hence these relays will not tend to follow signals from the superposed circuit.

As long as the system is balanced there is no tendency for signals from the circuits on which the superposing is done to return through the superposed circuit.

It will be noted that the receiving relays in both the superposed circuit and the circuit upon which the superposing is done differ somewhat from the usual design. The relay coils connected in series with each of the line conductors have half the number of turns of the relay coil connected in series with the artificial line. Since there are two coils in the line conductors (of either side circuit or superposed circuit) connected in the manner to aid each other and to oppose the coil in the corresponding artificial line, the circuit (side circuit or superposed circuit) will balance for duplex operation in the usual manner. With regard to current from the superposed circuit, however, the third coil 6c in the artificial line is connected across points of equal potential, and, since the relay coils 6a and 6b in series with the line conductors now oppose one another, the total resultant flux in the relay is zero.

The operation of the circuit is, briefly, as follows:

Assuming that it is desired to transmit from a terminal set 3 at one end of the line 1, 1 to a terminal set 3 at the distant end thereof, the transmitter 10a of set 3 is operated in any usual manner to apply signal impulses of opposite polarities from source 10 through the tongue and contacts of the transmitter to the field winding 9 of generator 5. If other factors governing the amount and direction

of the voltage across the armature of the generator are fixed, the armature voltage will depend entirely upon the direction and amount of current in the field winding of the generator. The signal shaping network 11 makes it possible to vary this voltage with frequency so as to compensate for the attenuation and consequent distortion of the signal waves by transmission through the line conductors. Hence, by proper adjustment of the condenser and resistance, the signal impulses are shaped before transmission so that when received at the distant end of the line, they are of proper form to operate a receiving relay.

Signals from the transmitter of set 3 do not cause operation of the relay 6 of the same set, since the transmitter and receiver are balanced for duplex operation by means of artificial line 7, the relay coils 6a and 6b being connected to aid each other and to oppose coil 6c with respect to currents from its own transmitter.

Incoming signals from the transmitter of the distant terminal set operate the relay 6 of this set, but do not cause operation of relay 6 of the distant set because that set also is designed for duplex operation by means of a balancing line 7.

Similarly two-way communication can be had over conductors 2, 2 of the other side circuit by means of terminal sets 4, 4. Transmitted currents from each of these sets operate the receiver of the corresponding set at the opposite end of the line, but do not operate the receiver of the home set.

When two-way communication over the superposed circuit is desired, the signal shaping networks 31 at the terminals of the circuit are suitably adjusted to control the currents in the field windings 29 and thus to control the voltage applied to the line at the terminals of the armatures 28.

Currents produced in the armature of generator 25 do not affect the receiver 26 of the home set, but operate the receiver 26 of the distant set on the superposed circuit. Nor do these currents cause operation of any of the receivers 6 of the terminal sets 3, 3 and 4, 4, because the superposed current flows through the two halves of the armatures of the generators of these sets by way of the center taps of these armatures, and in each case the circuits are balanced with respect to the armature center taps and relay coils so that the resultant flux in each receiver 6 is zero.

Currents produced in the armature of a generator 5 of any one of the terminal sets 3, 3 and 4, 4 will not affect the superposed circuit, for the side circuit conductors are carefully balanced and the superposed circuit conductor 21, being connected to the electrical center of the armature is, obviously, neutral for currents generated in the armature.

The side circuits and superposed circuit function in generally the same manner as those described in the pending application of R. V. Morgenstern, Serial No. 258,948 filed March 3, 1928, entitled "Superimposed telegraph circuits." In that application a high impedance shunt about the transmitting generator is employed to obtain a center tap for the superposed circuit.

The advantages of a system according to this invention over the arrangement shown in application Serial No. 258,948 are twofold. It is possible to design a generator with an armature suitable for use with a superposed system which will have a much lower resistance to the superposed circuit than will a suitable shunt. In addition, the elimination of the shunt from the superposed system makes possible the use of a smaller size generator, because it is no longer necessary to provide for the current drain through the shunt.

It is obvious that the invention is not limited to the specific arrangement shown in the drawing. Numerous variations therefrom or developments thereover may be made without departing from the spirit of the invention. In view of the fact that the superposed circuit set, or "phantom" set, is similar to the side circuit sets, it is obvious that the superposed circuit is adapted to have an additional circuit superposed thereon. This is indicated diagrammatically on the figure by the showing of a third contact or brush on the superposed circuit generator at the electrical center of its armature.

We claim:

1. In a superposed telegraph system, a side circuit, generators at each end of the circuit, means to provide for polar signaling over said circuit by field reversals in said generator and means for superposing a circuit on said circuit by way of the armatures of said generators.

2. In a superposed telegraph system, a pair of side circuits and a phantom circuit, generators at each end of the side circuits, means to provide for polar signaling over said circuits by field reversals in said generators, and means establishing non-interfering two way communication over said phantom circuit by way of conductors connected to the electrical centers of the armatures of said generators.

3. In a superposed telegraph system, a side circuit comprising a transmitter and a receiver, a generator having its armature connected in said circuit in conjugate relation with respect to the receiver and having its field under control of the transmitter, and a superposed circuit connected to the electrical center of said armature.

4. In a superposed telegraph system, a side circuit comprising a transmitter and a receiver, a generator having its armature con-

nected in said circuit in conjugate relation with respect to the receiver and having its field under control of the transmitter, and a superposed circuit comprising a generator having its armature connected to the electrical center of the armature of said side circuit generator, and means for controlling the field of said superposed circuit generator in accordance with signals.

5. In a superposed telegraph system, transmitting apparatus for a side circuit comprising a generator having a field winding and an armature and means for superposing a circuit on said side circuit by way of a conductor connected to the electrical center of said armature.

6. In a superposed telegraph system, transmitting apparatus for the side circuit comprising an armature provided with a center tap, a field winding and means shaping the current in said field winding for producing signals, and means to establish a path of low resistance to superposed signals by way of said center tap over the portions of said armature in parallel.

7. In a superposed telegraph system, a source of signalling current for the side circuit comprising a generator having a field winding and an armature winding, means for varying the current in said field winding in accordance with signals to produce in said armature winding an amplified current having corresponding variations, a receiver for the superposed circuit operatively connected to the electrical center of said armature winding, whereby the variations of said side circuit source are balanced with respect to said superposed circuit receiver.

8. In a superposed telegraph system, a side circuit, a generator at a terminal of said circuit, a transmitter and a receiver for said side circuit, means to associate said transmitter and receiver in conjugate relation with one another by way of said generator, a transmitter and receiver for the superposed circuit, means for associating said superposed circuit transmitter in conjugate relation with its own receiver and in conjugate relation with the side circuit receiver by way of said generator.

In testimony whereof we affix our signatures.

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