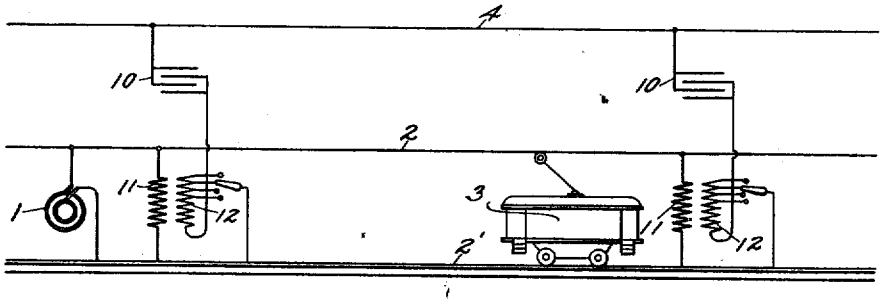
J. B. TAYLOR.

NEUTRALIZING INDUCTIVE DISTURBANCES.

APPLICATION FILED JULY 28, 1906.

996,376. **Patented June 27, 1911.**



Witnesses:

Murray D. Badgley

Helen Alford

Inventor:

John B. Taylor

By Albert G. Davis

Atty.

UNITED STATES PATENT OFFICE.

JOHN B. TAYLOR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

NEUTRALIZING INDUCTIVE DISTURBANCES.

996,376. Specification of Letters Patent. Patented June 27, 1911.

Application filed July 28, 1906. Serial No. 328,162.

To all whom it may concern:

Be it known that I, JOHN B. TAYLOR, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Neutralizing Inductive Disturbances, of which the following is a specification.

In general, any conductor which is charged or carrying current induces an electromotive force in neighboring conductors and thus raises the potential of these conductors above the earth potential. This induced electromotive force may or may not be considered a disturbance, depending on its magnitude and the use to which the conductor is put. In the most common case where this disturbance becomes a serious matter, as in the case of telephone or telegraph lines which are exposed to alternating current transmission lines, the disturbance may be due to electrostatic, or electromagnetic induction, or both together, depending on the relative locations of two circuits, the voltage and frequency of the alternating-current system, and the current carried by the conductor.

In general, a "balanced" single-phase, or poly-phase, transmission line gives little trouble to neighboring conductors, and by suitable transpositions the disturbance can be either entirely eliminated, or reduced to such a point that it is no longer a serious matter. As soon, however, as the transmission line becomes unbalanced (a line is balanced only so long as the algebraic sum of the currents in the conductors equals zero, and the algebraic sum of the potentials also equals zero,) it is impossible to neutralize the inductive action by transpositions. The neighboring conductors will, therefore, be at a potential different from the earth potential and thus disagreeable shocks may be experienced by those using or coming in contact with these conductors, or, if these conductors are portions of a telephone line, for example, the line may be noisy unless its insulation is practically perfect.

The simplest and typical case of an unbalanced system, which may cause disturbance on telephone or telegraph lines, is the single-phase trolley. In this case a single conductor is connected to one terminal of an alternating-current generator; return circuit being formed through the earth, or what amounts to the same thing, through rails laid on the surface of the earth. In such a case it is, obviously, impossible to transpose the working conductor, or trolley with the rails, and while there may be certain positions in which a conductor (such as a telegraph line) would be equally affected by current in trolley and rails, it is difficult to find this position and impracticable to suspend the telegraph or telephone lines at such a point.

The object of the present invention is to provide means for neutralizing the effect of electrostatic induction in a signaling conductor such as a telegraph or telephone line located in proximity to an alternating current transmission line. By this neutralization, I mean reducing the potential of the signaling conductor to substantially that of the earth potential.

It consists in means for producing an electromotive force sufficient to counter-balance that induced in the signaling conductor.

The accompanying drawing is a diagram showing a mode of neutralizing the effect of electrostatic induction.

In the figure there is shown an alternating current generator 1, which simply for the sake of illustration is represented as a single phase generator supplying current to a transmission line 2, such for instance as an overhead conductor conveying current to a trolley car 3. The return is through the earth or the rails, 2'. In proximity to this line is a signaling conductor 4, such for example as a telegraph or telephone wire. The two wires form a condenser, which causes the potential of the telegraph wire to vary with the alternations of potential in the trolley wire. This potential may be neutralized—that is, reduced to substantially that of the earth potential—by an artificial condenser 10 one terminal of which is connected with the telegraph wire 4 and the other with a source of potential which is always in opposition to the potential of the trolley wire. One mode of securing this potential is by means of a transformer, whose primary 11 is connected between the trolley wire and the ground, and its secondary 12 between ground and the condenser 10. Care must be taken that the connections are so made that the condenser neutralizes instead

of adds to the charge induced by the trolley wire. If the capacity of the artificial condenser 10 is equal to that of the two wires, the secondary winding of the potential transformer should have approximately the same number of turns as the primary. It is obvious that the relative capacities may vary, provided the secondary of the transformer gives the proper electromotive force. In the drawing, several taps are shown leading from the secondary 12 as a convenient means for securing the proper potential. It is also obvious that instead of adjusting at this point, the condenser 10 might be made adjustable.

Inasmuch as it is customary to operate the single-phase trolley line at a constant potential, a single condenser 10 may be sufficient. However, since on long lines the potential is likely to drop as the distance from the generator increases, several condensers distributed along the line would more nearly approach the ideal condition; two being shown in the drawing.

It will be obvious that although I have shown my invention as applied to a trolley line with a ground or rail return, it may be applied to any electrical system of conductors; and thus, while I have shown one form of the application of my invention, I do not desire to limit myself to the particular construction or arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. Means for neutralizing electrostatic induction between an insulated conductor and parallel adjacent conductors of an alternating-current system, comprising a device arranged to reduce the potential of the insulated conductor to substantially that of the earth potential by impressing upon the insulated conductor an electrostatic charge equal and always in opposition to the charge induced upon it by the conductors of the alternating-current system.

2. Means for neutralizing electrostatic induction between an aerial conductor and a conductor of an alternating-current system parallel and adjacent to the aerial conductor, comprising a device arranged to reduce the potential of the aerial conductor to substantially that of the earth potential by impressing upon the aerial conductor an electrostatic charge equal and always in opposition to the charge induced upon it by the conductor of the alternating-current system.

3. Means for neutralizing electrostatic induction between an aerial conductor and an inducing adjacent parallel conductor carrying an alternating-current, comprising a condenser one terminal of which is connected with the first conductor and the other terminal of which is connected with a source of potential always in opposition to the potential of the inducing conductor.

4. Means for neutralizing electrostatic induction between an aerial conductor and an inducing adjacent parallel conductor of an alternating-current system, comprising an artificial condenser one terminal of which is connected with the first conductor and the other terminal of which is connected to the secondary of a transformer whose primary is connected between the inducing conductor and another conductor of its system.

5. Means for neutralizing electrostatic induction between an aerial signaling conductor and an inducing adjacent parallel conductor of an alternating-current system, comprising a transformer whose primary is connected between the inducing conductor and another conductor of its system, and whose secondary has one terminal so connected to means for adjusting its impressing voltage to this other conductor and is so connected to one terminal of a condenser whose second terminal is connected with the signaling conductor as to charge the condenser with a potential always in opposition to the potential of the inducing conductor.

6. Means for neutralizing electrostatic induction between an aerial signaling conductor and the trolley-wire of a single-phase trolley-line, comprising a device arranged to reduce the potential of the signaling conductor to substantially that of the earth potential by impressing upon the signaling conductor an electrostatic charge equal and always in opposition to the charge induced upon it by the trolley-wire.

7. Means for neutralizing electrostatic induction between an aerial signaling conductor and the trolley-wire of a single-phase trolley-line, comprising an artificial condenser, one terminal of which is connected with the signaling conductor and the other terminal of which is connected with a source of potential always in opposition to the potential of the trolley-wire.

8. Means for neutralizing electrostatic induction between an aerial signaling conductor and the trolley-wire of a single-phase trolley-line, comprising an artificial condenser one terminal of which is connected with the trolley-wire and the other terminal of which is connected with the secondary of a transformer whose primary is connected between the trolley-wire and ground.

9. Means for neutralizing electrostatic induction between an aerial signaling conductor and the trolley-wire of a single-phase trolley-line, comprising a transformer whose primary is connected between the trolley-wire and ground, and whose secondary has one terminal so connected to means for adjusting its impressing voltage to ground and is so connected to one terminal of a condenser

whose second terminal is connected with the signaling conductor as to charge the condenser with a potential always in opposition to the potential of the trolley-wire.

10. The method of neutralizing electrostatic induction between an insulated conductor and parallel adjacent conductors of an alternating-current system, consisting in reducing the potential of the insulated conductor to substantially that of the earth potential by impressing upon the insulated conductor an electrostatic charge equal and always in opposition to the charge induced upon it by the conductors of the alternating-current system.

In witness whereof, I have hereunto set my hand this 27th day of July, 1906.

JOHN B. TAYLOR.

Witnesses:
BENJAMIN B. HULL,
GRACE M. HARRIGAN.