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E. BLAKENEY.

MEANS FOR NULLIFYING INDUCTIVE INTERFERENCE BETWEEN PARALLEL CIRCUITS.

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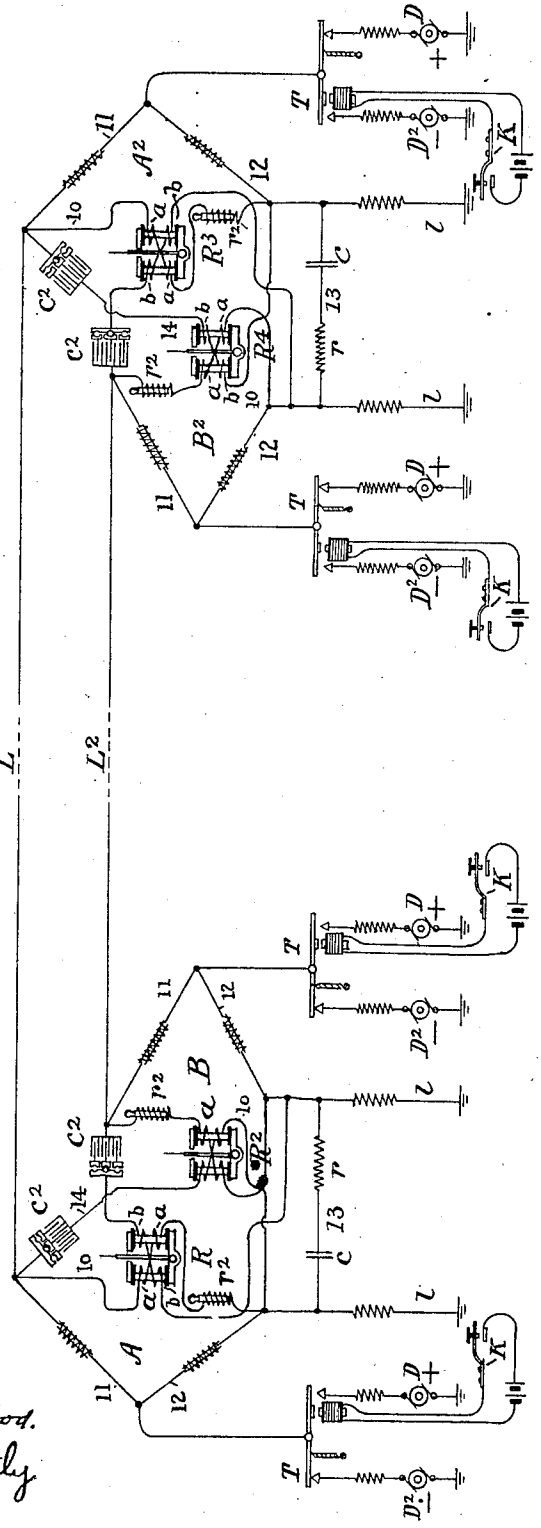

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MEANS FOR NULLIFYING INDUCTIVE INTERFERENCE BETWEEN PARALLEL CIRCUITS.

No. 851,856. Specification of Letters Patent. Patented April 30, 1907.

Application filed January 7, 1907. Serial No. 351,245.

To all whom it may concern:

Be it known that I, EDWARD BLAKENEY, residing at Ossining, in the county of Westchester and State of New York, have invented certain Improvements in Means for Nullifying Inductive Interference Between Parallel Circuits, of which the following is a specification.

This invention has for its principal object the prevention of inductive disturbances in signaling circuits, and is especially concerned with the nullifying or neutralizing of that mutual action between muliplex telegraph systems which is manifested in the receiving instrument at a distant station.

It consists in a novel method of and means for accomplishing this result, wherein a portion of the inducing current in one circuit is caused to act upon an instrument in an adjacent circuit to neutralize the effect of the induced current.

In the accompanying diagrammatic representation of a system adapted for the carrying out of the invention, L, L^2 represent telegraph lines which are so closely adjacent that current changes in one will induce currents in the other. They might, for example, consist of a pair of conductors included in a cable, each of said conductors being independently employed as a telegraph line. The lines L and L^2 have terminal stations A A^2 and B B^2, respectively, which are arranged in pairs A, B and A^2, B^2, with the stations of each pair situated in comparative proximity.

Each line is shown as arranged for multiplex transmission, the particular system illustrated being a polar bridge duplex. This is too well understood to require specific description. It may be briefly said that at each station is a receiving instrument or relay, those at the stations A, B, A^2 and B^2 being respectively designated by the characters R, R^2, R^3 and R^4. Each relay is polarized and has its operating coils *a* included in a conductor 10 bridged between the main line and a suitable artificial line 1, said lines forming two arms of a Wheatstone balance, while conductors 11 and 12 containing the usual resistances, furnish the other two arms. These conductors 11 and 12 are joined to one another and connected to earth through the contacts of a transmitting apparatus T, and sources of electrical energy D D^2 having their opposite poles to line. The transmitters may be actuated by keys K. To this extent the system is well known.

In operation, for each depression and release of a key the current traversing the line is reversed, and at this time a momentary induced electromotive force will manifest itself throughout the adjacent line tending to distort signaling currents which may be flowing therein. This is felt in both the relay of the associated home station, from the companion station of which the disturbing current starts, and in that of the distant station. For the mutilation of signals of the home relay of the affected line by the outgoing induced impulses a remedy has already been proposed and found fairly satisfactory. This consists in connecting between the artificial lines of each pair of stations A B and A^2 B^2 a bridge conductor 13 including a condenser *c* and a non-inductive resistance *r*. By this means the impulse induced in the main line is balanced by a similar impulse communicated through the bridge 13 to the artificial line, these balancing one another in the bridge 10 and producing no effect upon the relay. Such an arrangement, however, has no influence upon the incoming induced current, since the operation of this duplex is dependent upon a difference of potential for incoming currents at the extremities of the bridge 10; and so far as is known to me the problem of neutralizing disturbances in the distant relay has not been solved. I overcome this difficulty by causing a proper portion of the inducing current to act upon the affected relay in a different manner or oppositely from the action of the induced current thereon. To this end there is connected in parallel with each of the bridges 10 a conductor 14 which contains coils *b* for the relay of the companion line; these coils *b* being wound differentially from the main coils *a*, or so that the inducing and induced currents flow about the cores of the relays in opposite directions. In each of the conductors 14 is a condenser c^2, preferably of variable capacity, and each bridge 10 contains a preferably adjustable inductive resistance r^2.

It will be seen that the current flowing into a distant station, A^2 for example, after the depression of the key at A, will be divided between the operating winding *a* of the relay

R^3 in its own line L and the neutralizing winding *b* of the companion relay R^4. As this current in the coil *b* acts oppositely upon the second relay R^4 from the current induced in the line L^2 by the variation of current in the line L and passing through its operating winding *a*, the effect of the induced current will be nullified, if the impulses are equal in strength and duration, and coincide in time. By varying the resistance r^2, more or less current may be forced through the conductor 14, and providing a suitable capacity at c^2 the correcting pulse will be momentary, as is that induced. That is, the intensity and rate of application of the correcting pulse is thus controlled. Moreover, these impulses pass through the coil at practically the same instant, thus the induced current is neutralized and the incoming signals are undisturbed. On the other hand the outgoing signals will not influence the corrected relay, since for them the junctures of the conductors 10 and 14 are at equal potential, a condition essential to the operativeness of the telegraph system. Their inducing effect will be compensated for by the bridge 13, as has been already described.

I claim:

1. The method of nullifying inductive disturbance of one telegraph line upon a receiving instrument located in another line at a point distant from the point of transmission of an inducing current in the first-mentioned line, consisting in causing said inducing current in the first line to act upon said receiving instrument in the second line in a different manner from the induced current in said second line.

2. The method of nullifying inductive disturbances between signaling conductors, said disturbances arising from the operation of a transmitting instrument at one station and affecting a receiving instrument at a distant station, which consists in causing the inducing current in one conductor to act upon the distant receiving instrument of another conductor in the opposite direction from the induced current in said distant instrument.

3. The method of neutralizing the effect of mutual induction between two multiplex telegraph lines manifested in their receiving instruments which are distant from the point of transmission of an inducing current, consisting in dividing the inducing current part to said distant receiving instrument of one line and part to said distant receiving instrument of the other line, and causing said current to act differentially upon said instruments.

4. The combination with adjacent signaling lines each having a receiving instrument, of a winding located upon a receiving instrument, and being connected only with a companion line.

5. The combination with adjacent signaling lines each having a receiving instrument, of a winding located upon a receiving instrument and being connected only with a companion line, and means for causing the current flowing through said winding from the companion line to act momentarily upon the receiving instrument.

6. A telegraph system comprising a plurality of adjacent lines each provided with terminal stations, receiving instruments situated at the stations and each having an operating winding included in the line to which it belongs, and a second winding for each receiving instrument independent of its operating winding and being connected with another of the lines.

7. A telegraph system comprising a plurality of adjacent lines each provided with terminal stations, receiving instruments situated at the stations and each having an operating winding included in the line to which it belongs, a second winding for each receiving instrument independent of its operating winding and being connected with another of the lines, and condensers included in the connections of the second windings, substantially as described.

8. A multiplex telegraph system comprising adjacent main lines provided with terminal stations, an artificial line associated with each main line at each terminal station, a receiving instrument bridged between each artificial line and its main line, and means for applying to each receiving instrument a portion of the current flowing from the distant station of a companion line.

9. A multiplex telegraph system comprising adjacent main lines provided with terminal stations, an artificial line associated with each main line at each terminal station, a receiving instrument bridged between each artificial line and its main line, means for applying to each receiving instrument a portion of the current flowing from the distant station of a companion line, and means for controlling the rate of application of said current.

10. A multiplex telegraph system comprising adjacent main lines provided with terminal stations, an artificial line associated with each main line at each terminal station, a receiving instrument bridged between each artificial line and its main line, and a conductor connected in parallel with the bridged receiver and including a coil upon the receiving instrument at the same end of a companion line, as and for the purpose set forth.

11. A multiplex telegraph system comprising adjacent main lines provided with terminal stations, an artificial line associated with each main line at each terminal station, a receiving instrument bridged between each artificial line and its main line, a conductor connected in parallel with the bridged

receiver and including a coil upon the receiving instrument at the same end of a companion line, and means for varying the distribution of current between the parallel conductors.

12. In a duplex telegraph system the combination with two main lines so situated that they may act inductively upon one another and being provided with stations arranged in pairs, said pairs including a station of each line in comparative proximity to one another, an artificial line at each station, a bridge conductor connecting each artificial line with its main line, a relay having a coil connected in the bridge, a conductor connected to the main and artificial lines in parallel with the bridge conductor, and a differential coil upon each relay included in the parallel conductor of the companion station.

13. The combination with adjacent signaling lines, one of which is provided with a receiving instrument and another with a distant transmitting instrument, of means associated with said receiving instrument and connected to the second line to receive current transmitted by the said distant transmitting instrument.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 24th day of December 1906.

EDWARD BLAKENEY.

Witnesses:
WILLIAM E. ATHEARN,
CHARLES S. SCALES.