(No Model.)

J. J. CARTY.

MEANS FOR REDUCING INDUCTIVE DISTURBANCES IN TELEPHONE CIRCUITS.

No. 442,856. Patented Dec. 16, 1890.

Fig. 1.

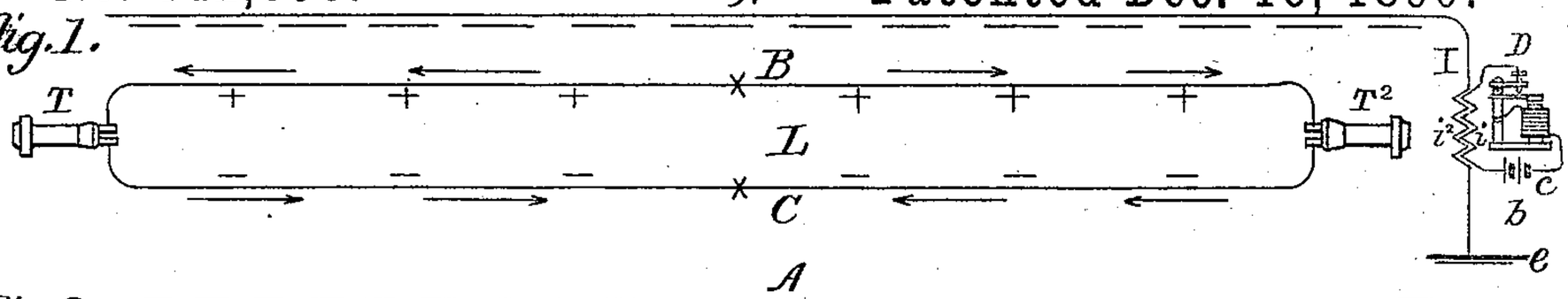


Fig. 2

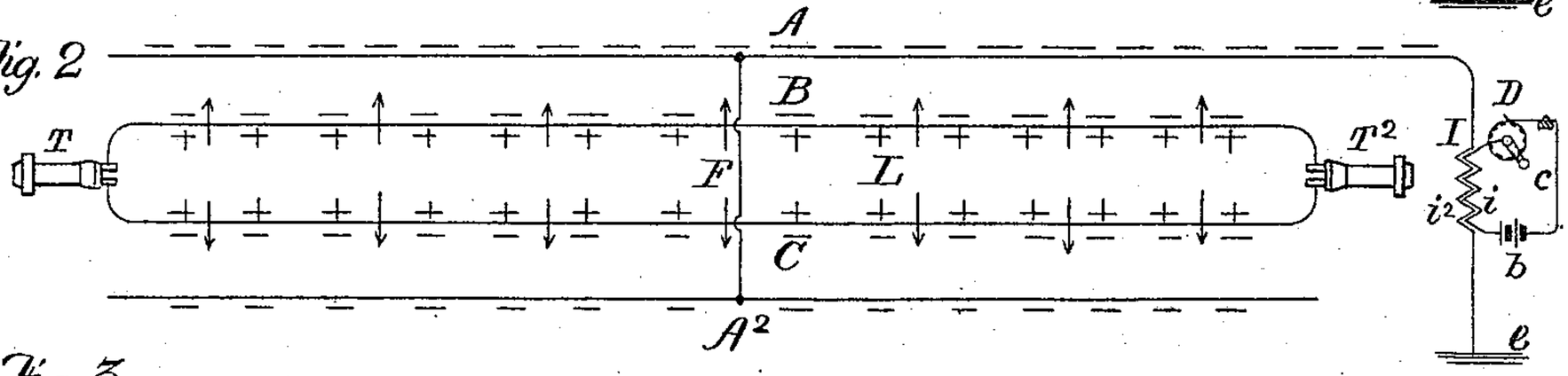


Fig. 3.

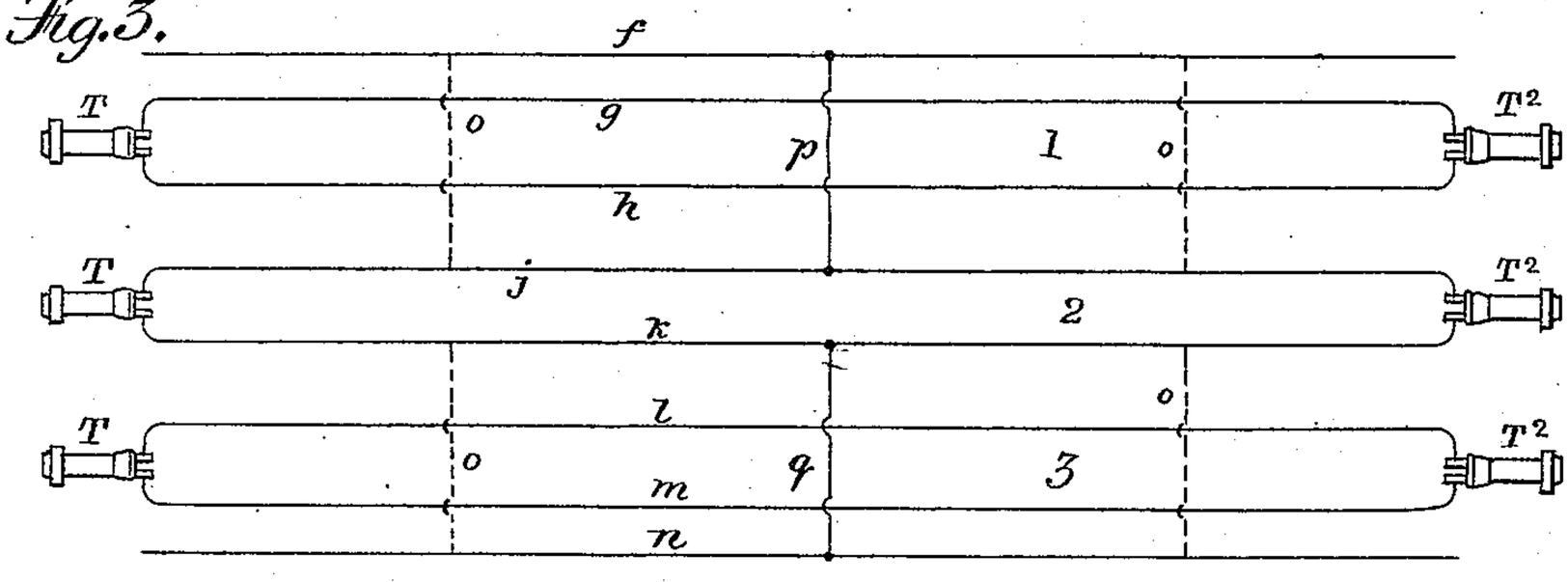


Fig. 4.

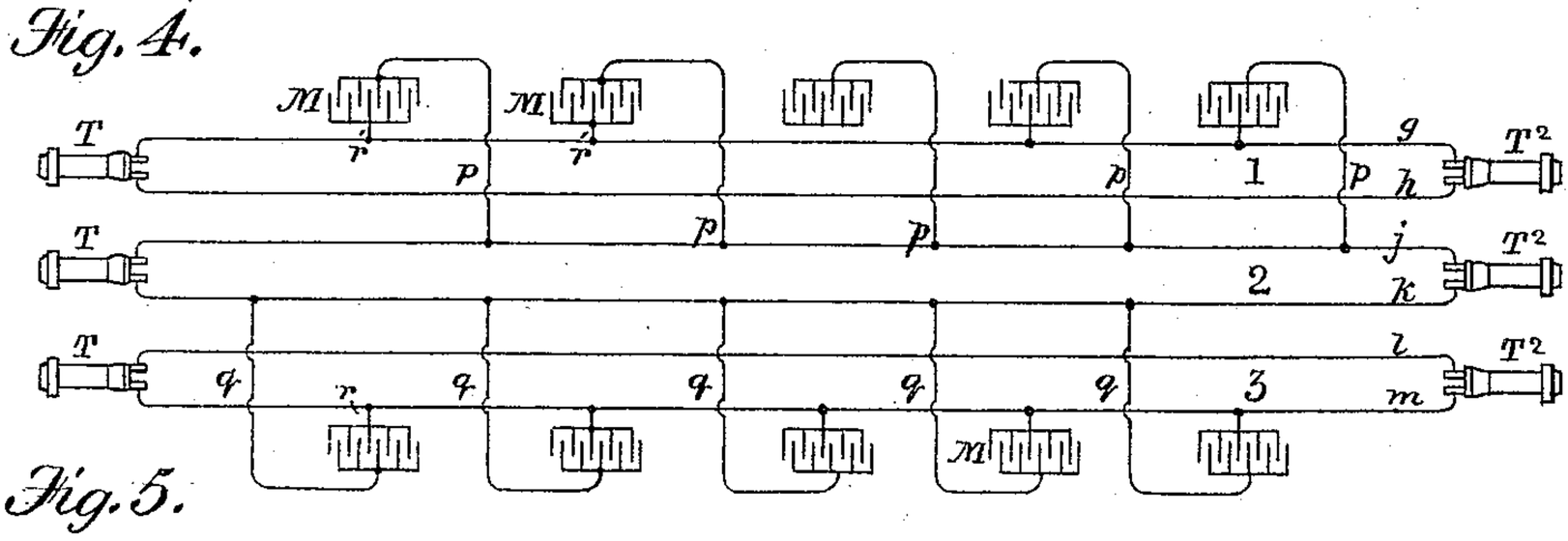
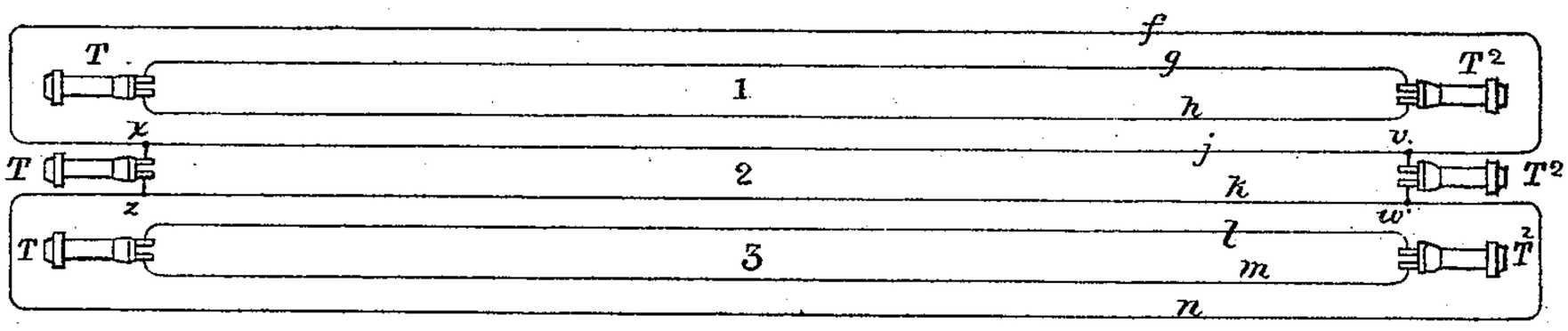


Fig. 5.



Witnesses.
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UNITED STATES PATENT OFFICE.

JOHN J. CARTY, OF NEW YORK, N. Y.

MEANS FOR REDUCING INDUCTIVE DISTURBANCES IN TELEPHONE-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 442,856, dated December 16, 1890.

Application filed September 18, 1890. Serial No. 365,317. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. CARTY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Means for Reducing Inductive Disturbances in Telephone-Circuits, of which the following is a specification.

This invention relates to the several electrical disturbances which beset telephonic circuits, and especially to those which are attributable to induction from other and parallel circuits. Experience has demonstrated that these are largely due in many cases to electrostatic induction or to the varying influences of charge and discharge and to the redistribution and rearrangement of the former.

The object of my present invention is to improve telephonic transmission over metallic circuits by eliminating the effects of electrostatic induction. I do this by so arranging the disturbing-circuit that it shall be enabled to exercise an equal electrostatic effect upon both sides—that is to say, on both line-conductors—of the metallic circuit which is or which otherwise would be disturbed.

In the drawings which form a part of this specification, Figures 1 and 2 are diagrams illustrating the principle of compensation which is embodied in my invention, and Figs. 3, 4, and 5 are diagrams which show, respectively, different modes of practically carrying out the said invention.

In Fig. 1, A is the disturbing-wire, which, simply for illustration, I will consider as being discontinuous at the outer end and as being at a given moment charged to a definite negative potential by the electrotome D, which intermits the current of the battery *b* in a local circuit *c*, within which the primary helix *i* of the induction-coil I is included. The secondary helix i^2 of said induction-coil is in the line-circuit, and the entire apparatus may be regarded as the source of sound. The said negative charge on A of course tends to induce a substantially equal positive charge, indicated by the plus-symbol on the line-wire B of the parallel metallic circuit L, and consequently a negative charge of like amount on the more distant linear conductor C of the same circuit. Speaking conventionally, we may say that the electricity of the circuit L is decomposed, a positive charge being attracted to the side B nearest to the inducing charged wire, while a corresponding charge of negative sign is repelled to the more distant conducting-surface of C. This redistribution results, of course, in currents through telephones T and T^2, producing noise correponding to the note given out by the electrotome, and if the disturbing-line A were engaged in telephonic transmission the telephones T and T^2 would reproduce the speech transmitted over A. In Fig. 2 a similar arrangement is illustrated, but in addition thereto a remedial agency is disclosed. The metallic telephone-circuit L is identical with that shown in Fig. 1, the telephone T being included therein at one end and the telephone T^2 at the other. The disturbing-conductor A, having an earth-terminal *e* and provided with the induction-coil I, through which vibratory impulses are thrown onto the line tending to produce a musical note and actually establishing thereon as long as the line is open, a varying potential, is now provided with an associate line-conductor A^2, holding the same inductive relation to the conductor C of the metallic circuit L as does A to the conductor B thereof—that is, the wire A^2 is run parallel to and for the same length as C and at the same distance therefrom as A is from B. A cross-wire or connecting-conductor F, located at any suitable point of the line, unites A and A^2. When these are joined, as shown, the disturbing-wire being operative, no sound is heard either at T or T^2. This is readily explained by a consideration of the conditions, for A^2, being at all times at the same potential as A, acts with the same force on C that A does on B, and while A does, indeed, tend at any given moment to attract a positive charge on B and to repel an equal and opposite charge to C, it is also true that its associate conductor A^2, electrified at the same moment to the same potential, tends to attract a positive charge to C and to repel an equal and opposite charge to B. The resultant effect is of course zero, or neutrality, or, as indicated by the arrows, the flow or rearrangement of electricity will be lateral and the telephones T and T^2 will be silent.

Fig. 3 shows a practical utilization of the

principles I have thus enunciated. In it they are applied to a system of three circuits. Circuits 1 and 3 are simply metallic telephone-circuits, each having terminal telephone-stations, where are located, respectively, telephones T and T². The central circuit 2 has, in addition to its two component conductors *j*, and *k* two wing conductors *f* and *n*. Its line conductor *j*, parallel with and adjacent to conductor *h* of circuit 1, is united by cross-wire *p* with the lateral or wing conductor *f*, extended on the other side of circuit 1 and in similarly adjacent proximity to conductor *g* of said circuit, and its other main conductor *k*, being itself extended parallel with and in proximity to wire *l* of circuit 3, is in like manner united by cross-wire *q* to the lateral or wing conductor *n*, similarly extended in like inductive relation to the main wire *m* of circuit 3. If the circuits are long, it will sometimes be found advantageous to unite the lateral to their respective main conductors by additional cross-wires, as indicated in dotted lines *o*. By this arrangement the circuits 1, 2, and 3 are freed from disturbance due to electrostatic induction or variation of charge. The action of the compensating-wires *f* and *n* is like that of a condenser, each wire acting as one plate. It will be apparent, therefore, that they may be replaced by a series of condensers distributed along the line, their total capacity equaling the capacity of the compensating-wire which they replace. Fig. 4 shows a similar three-circuit system balanced in this way by the substitution of condensers for the lateral wires *f* and *n*. The circuits 1 2 3 each are metallic circuits, and are collectively composed of the wires *g*, *h*, *j*, *k*, *l*, and *m*. Instead of the lateral extensions of the central circuit, I provide on each outer side of the circuits 1 and 3 a series of condensers M, each having one of its plates united by a wire *p* or *q* to that wire of the central circuit to which it is nearest, the other plate of said condensers being in each instance united by a wire *r* to the outer wire of the side circuit 1 or 3, as the case may be.

Fig. 5 illustrates a modification of my invention wherein the compensating-wires *f* and *n* are utilized as extra conductors for the middle circuit 2, being joined thereto at one end at the points *v* and *w* and at the other end at the points *x* and *z*.

It is also apparent from a study of the drawings that not only is the middle circuit enabled by the construction shown to act inductively with equal effect upon both lines of either side circuit, but that by a parity of reasoning such inductive influence as is exercised by either side circuit on the neighboring wire of the middle circuit will be exerted by means of the lateral extensions by both conductors of said side circuits, respectively, one acting directly upon the main conductor of said middle circuit and the other acting through the parallel branch or lateral extension thereof.

Having now fully described my invention and my mode of preventing "cross-talk" (as the most common disturbance between telephonic metallic circuits is technically termed) by means of the establishment of an electrostatic balance, I claim—

1. Three or more metallic electric circuits extending parallel to each other, as described, combined with means, such as the lateral branches or condensers, connected with the central circuit and extended along the more distant conductor of the side circuits, as specified herein, whereby each conductor of the said central circuit is enabled to exercise equal and like electrostatic inductive effects upon both near and distant conductors of its adjacent side circuits, for the purposes set forth.

2. Three or more metallic telephone-circuits extended parallel to each other, as described, one of the said circuits being arranged between the other two, branch or wing conductors extended on the outer side of each of the outer circuits in like inductive proximity to the outer conductors thereof as are the two sides of the middle circuit to the respective inner conductors of the said two outer circuits, and cross-connections uniting the said branch conductor respectively to the nearest conductor of the middle circuit, whereby each of the said branch conductors is made a lateral extension of the main conductor to which it is electrically connected, and whereby both conductors of each side circuit are brought into equal inductive proximity with the nearest conductor of the middle circuit, for the purposes described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of September, 1890.

JOHN J. CARTY.

Witnesses:
L. H. LANDON, Jr.,
HERBERT LAWS WEBB.