

(No Model.)

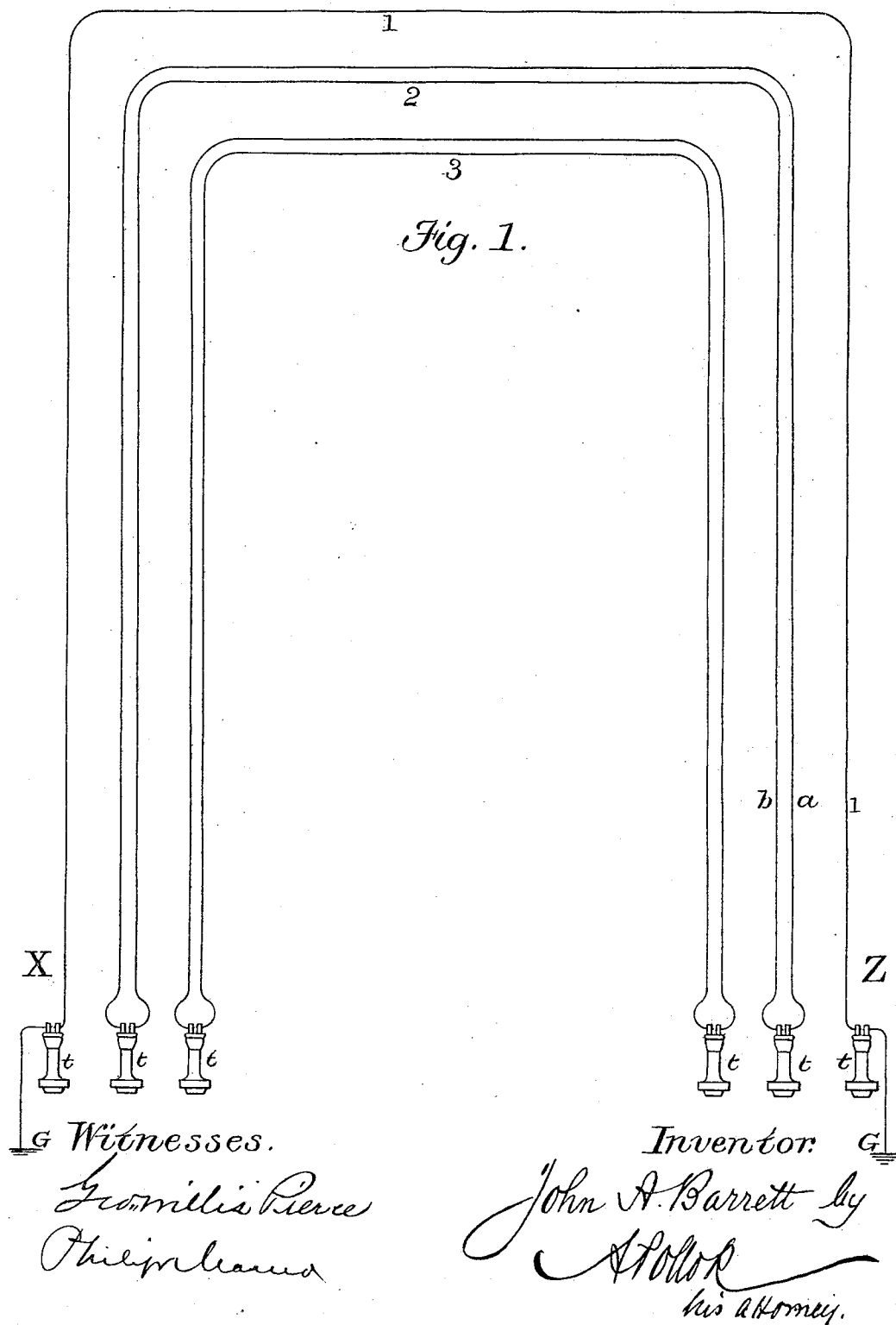
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No. 397,331.

Patented Feb. 5, 1889.

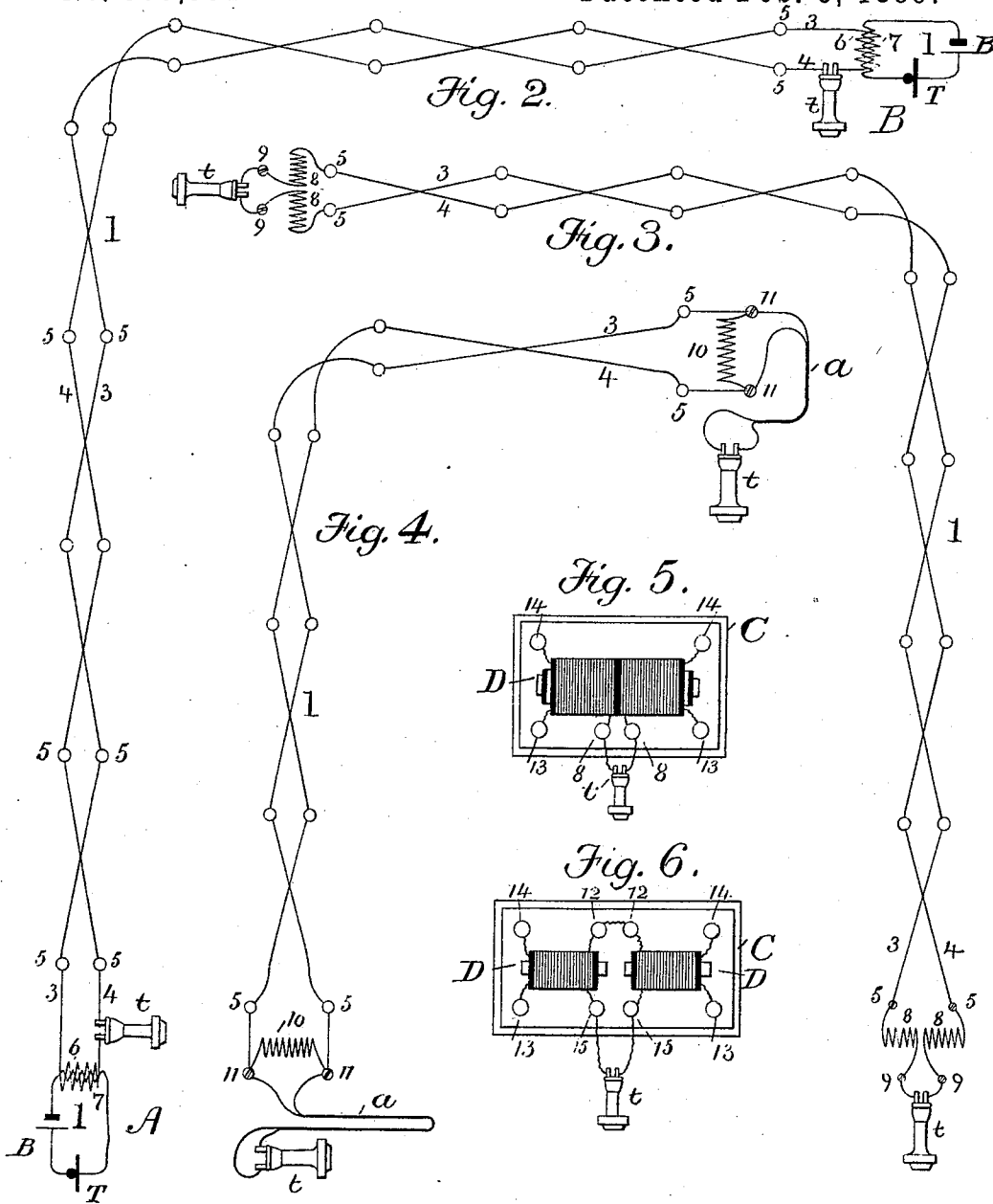


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Patented Feb. 5, 1889.



Witnesses.

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TELEPHONE CIRCUIT AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 397,331, dated February 5, 1889.

Application filed May 9, 1888. Serial No. 273,304. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. BARRETT, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Telephone Circuits and Apparatus, of which the following is a specification.

The object of my invention is to reduce, and wherever practicable, to obliterate the adverse effects of inductive disturbances upon telephone-lines.

It is well known that when two electrical conductors are placed in juxtaposition sudden variations of the electrical condition of one will develop variations in the other more or less pronounced, according to the nature of the original changes, the proximity of the conductors in question, and the amount of surface exposed to inductive action. Such induced variations are very troublesome in their effect upon telephonic instruments included in the circuit of either conductor, and to neutralize the ill effects thereof in the telephone-circuit, and, in fact, to neutralize foreign currents therein, whether proceeding from parallel lines or from other causes, resort has been had to a complete metallic or double wire circuit in which both wires being parallel to one another and substantially equidistant from the source of disturbance the adverse currents meet and neutralize one another. Such substantial equidistance is, however, a condition of absolute success in the achievement of the desired end, and the degree of success is in all cases proportionate to the degree of exactness attained in establishing equidistance between each of the two conductors of a circuit and the several sources of disturbance. It is possible to perfect such an arrangement only when the two wires of each circuit are or can be twisted round one another, and this practice, though generally feasible in cables, is not easily carried out in pole-lines, for obvious reasons.

It has been found that when a number of metallic circuits are supported upon poles in the air in parallelism with one another the immunity of the several circuits from inductive disturbance is not perfect, and this imperfection in operation arises partly from the cir-

cumstance that the two conductors of any line are not, as ordinarily arranged, equidistant from the other circuits, and partly from another cause, to which I shall hereinafter advert.

To obtain the requisite conditions as far as possible, I cross-connect the two wires of each metallic circuit at the several cable-boxes at river-crossings and at as many other points upon the line as may be found convenient. In some cases it may be found necessary to so alternate the points of support upon the successive poles that the two wires of each circuit shall be actually twisted round one another many times between the respective termini of the line, so that each conductor of each line is in turn subjected to the same inductive influence as the other, and neutralization of adverse currents is thus in a great measure effected.

Actual practice has also demonstrated that even when the lines were substantially balanced in the manner described above one of the two lines of a circuit was more susceptible than the other to inductive disturbance, and I have further ascertained that this phenomenon was and is due to the circumstance that the apparent balance existing between the two sides of the circuit is, in fact, quite imperfect, and that the said imperfection arises from the presence of the receiving-magneto-telephone helix on one side or the other of the secondary helix of the transmitter, which, included directly in the line-circuit, may be regarded in each case as the source of transmitting energy for the circuit.

The electrical currents transmitted in any circuit act more energetically on that side of the circuit which does not include the receiving-telephone helix, and are made sluggish or are retarded upon that side in which the said helix is included; hence the currents in the two conductors of any single circuit, being uneven in strength and character, exercise different degrees of inductive influence upon the surrounding or neighboring circuits, and the two sides of such circuits are in turn also differentially susceptible to the said influence when emanating from other circuits.

To counteract these disturbing influences, and in general furtherance of the object of my invention, as hereinbefore stated, the invention consists in so disposing the magneto-helix with respect to the source of undulatory energy that the balance of the two sides of the circuit will not be thereby disturbed, and in combining this improvement with the several cross-connections of the two conductors of the circuit, so that both expedients will co-operate for the maintenance of said balance.

In the drawings which illustrate and which are a part of this specification, Figure 1 shows a system of parallel telephone-lines comprising both metallic and ground return-circuits. Fig. 2 represents in diagram a single metallic telephone-circuit cross connected at a number of points between its termini. Fig. 3 is a diagram of a metallic cross-connected circuit, showing the balanced position of the receiver. Fig. 4 is a diagram illustrating a modification in the plan of connecting the receiver with respect to the transmitter secondary coil, and Figs. 5 and 6 are induction-coils constructed in accordance with my invention.

In Fig. 1, 1, 2, and 3 are metallic and ground return parallel telephone-circuits extending between two stations, X and Z, at which stations they are provided, in the usual manner, with a telephone, *t*. The diagram indicates the order in which any number of circuits may be supported on the poles or cross-arms, and it is obvious that any one or a number of circuits so arranged cannot exercise an equal inductive effect upon both direct and return wire of any one circuit, inasmuch as, unless special measures are adopted, although the two wires are parallel to one another, they are not equidistant from each of the other circuits. Thus the ground-circuit I would exercise a stronger influence over wire *a* of circuit 2 than it could over wire *b* of the same circuit.

Fig. 2 shows the first step in my improvement, and also illustrates the essentiality of the second.

A double-wire circuit, I, is shown extending between two stations, A and B, and it is to be assumed that many or a number of like circuits are extended parallel thereto upon the same main supports. Each station is provided with the usual telephonic apparatus comprising a receiver and a transmitter. The transmitter T is included in the ordinary way in circuit with a local battery, B, and the primary helix 1 of an induction-coil, the secondary helix 6 whereof is included in the line-circuit, and is consequently, so far as the said line-circuit is concerned, the actual source of the electrical energy by means of which vocal transmission is effected.

The receiver *t* is also in the main circuit. The two wires 3 and 4 of the circuit are cross-connected or transposed at any number of convenient points, 5. Each cable-

house upon the line of route will preferably be utilized, and the wires may also be subjected to a series of gradual transpositions upon the poles, so that between the termini of the line each is brought into the inductive line of the other a number of times, and the neutralization of adverse currents is in a considerable degree effected.

The appliances at both stations are practically alike. It is to be noted, considering the induction-coil 6 as the source of energy for the circuit, that the receiving-telephone is connected in the said circuit on one side thereof. The helix of the said telephone is not only wound to a considerable resistance, but also encircles a magnetic core. Its presence, therefore, disturbs the balance which would otherwise exist between the two sides of the circuit, and, as hereinbefore explained, the results are disadvantageous, whether the circuit as a whole be regarded as the transmitter or recipient of the induced and disturbing currents. I have therefore devised and adopted the expedient shown in Fig. 3, in which the receiving-telephone *t* is connected in the middle of the secondary helix, the wire thereof being for that purpose divided into two equal portions, 8, the two inner ends of which are brought out and connected with the receiver-terminals through suitable connections, 9. When so arranged, it is evident not only that the transmitter-coil has an electro-motive force fully as potent as if it were undivided, but that the electro-motive force developed therein operates with equal vigor on both conductors 3 and 4 of the circuit, which are thus balanced. The conductors balanced in this way are, as hereinbefore indicated, less receptive to currents induced by other lines, and have also less influence upon other lines, and when all the parallel lines of a complete system are so arranged the results are extremely beneficial upon the general operation of the series.

An induction-coil constructed as in Fig. 5 may be employed for the above purpose. C is a base-board upon which the inductorium may be mounted. The inner or primary coil is connected with terminal binding-screws 13, and the outer secondary or line coil is terminated at the outer ends thereof by the binding-screws 14, the severed central ends being attached to the binding-screws 8, to which the terminals of the receiving-telephone *t* are likewise connected.

In Fig. 4 I show a modified plan of dividing the resistance of the telephone-helix between the two sides of the circuit, which modification is especially applicable to apparatus already in use, and which is therefore not readily accessible or convenient for radical change. By this plan the two line-conductors 3 and 4 are connected with the two terminals 11 of the secondary helix 10 of an induction-coil in the ordinary way, and the telephone-conductors are likewise united to the same terminals. The telephone-helix is

united by its double conducting-cord *a* to these binding-screws, constituting a derived circuit or shunt round the resistance of the induction-coil helix.

5 Fig. 6 shows another form in which the inductorium used in accordance with the first plan may be made. Two small but complete induction-coils may be provided, as D D. These are shown as being mounted upon the
10 same base C. The two primary helices are united by a wire joining their inner terminals 12, while their outer terminals 14 are connected in the transmitter-circuit. The secondary helices are connected by means of
15 their outer terminals 13 in the main-line circuit, while the two inner terminals 15 are connected with the receiving-telephone *t*.

I do not herein claim as my invention the plan of diminishing the induced currents
20 which disturb telephone-circuits by cross connecting the two wires of the said circuits; but

I do claim—

1. The combination, with a telephonic circuit, of a transmitter having the secondary
25 or line circuit of its induction-coil divided into two substantially equal parts, and a receiving-telephone connected to line between the parts of said coil, as set forth.

2. The combination, with a telephonic circuit, of a telephone-transmitter, an induction-coil, whereby the electrical changes produced by the action of said transmitter are propagated through said circuit, and a telephone-receiver connected in approximately the middle of the secondary or line helix of said
35 induction-coil, said helix being the source of electrical energy for said circuit, substantially as described.

3. The combination, with a telephonic circuit, of a telephone-transmitter, an induction-coil therefor, having its secondary or line helix, which constitutes the source of energy in said circuit, divided at or about its center of resistance, and a receiving-telephone looped
40 or connected to the severed terminals, substantially as described.

4. The combination of a metallic or double conductor telephone-circuit having its two sides cross-connected or transposed at one or more points with a transmitter induction-coil
50 having its secondary helix included in the said circuit and divided at its center, and a receiving-telephone interposed between the two halves of the said coil, substantially as and for the purposes specified.

5. A metallic or double wire telephone-circuit having its two conductors cross-connected or transposed at any number of suitable points, a receiving-telephone at the stations thereof
55 included in the said circuit, and a transmitter, also at the said stations, the secondary helix of the induction-coil whereof is also included in the said circuit on both sides of the said receiving-telephone helix, substantially as
60 specified, whereby the two conductors are equalized and a balance between them maintained.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of August, 70
1887.

JOHN A. BARRETT.

Witnesses:

F. DELYSLE SMITH,
THOS. D. LOCKWOOD.