P. STRAGIOTTI.

TELEPHONIC TRANSMITTER.

APPLICATION FILED AUG. 11, 1908.

958,561.

Patented May 17, 1910.

Fig. 1.

Fig. 5.

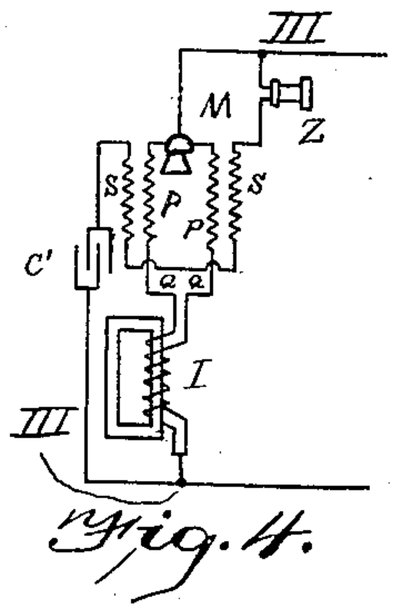
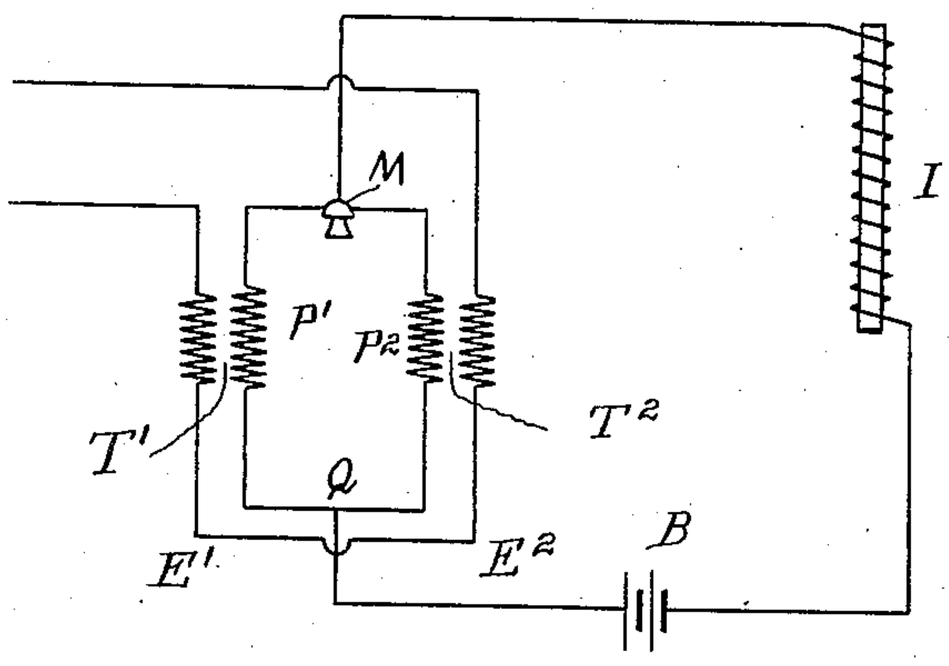
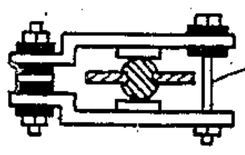


Fig. 4.





M differential microphone

Fig. 2.

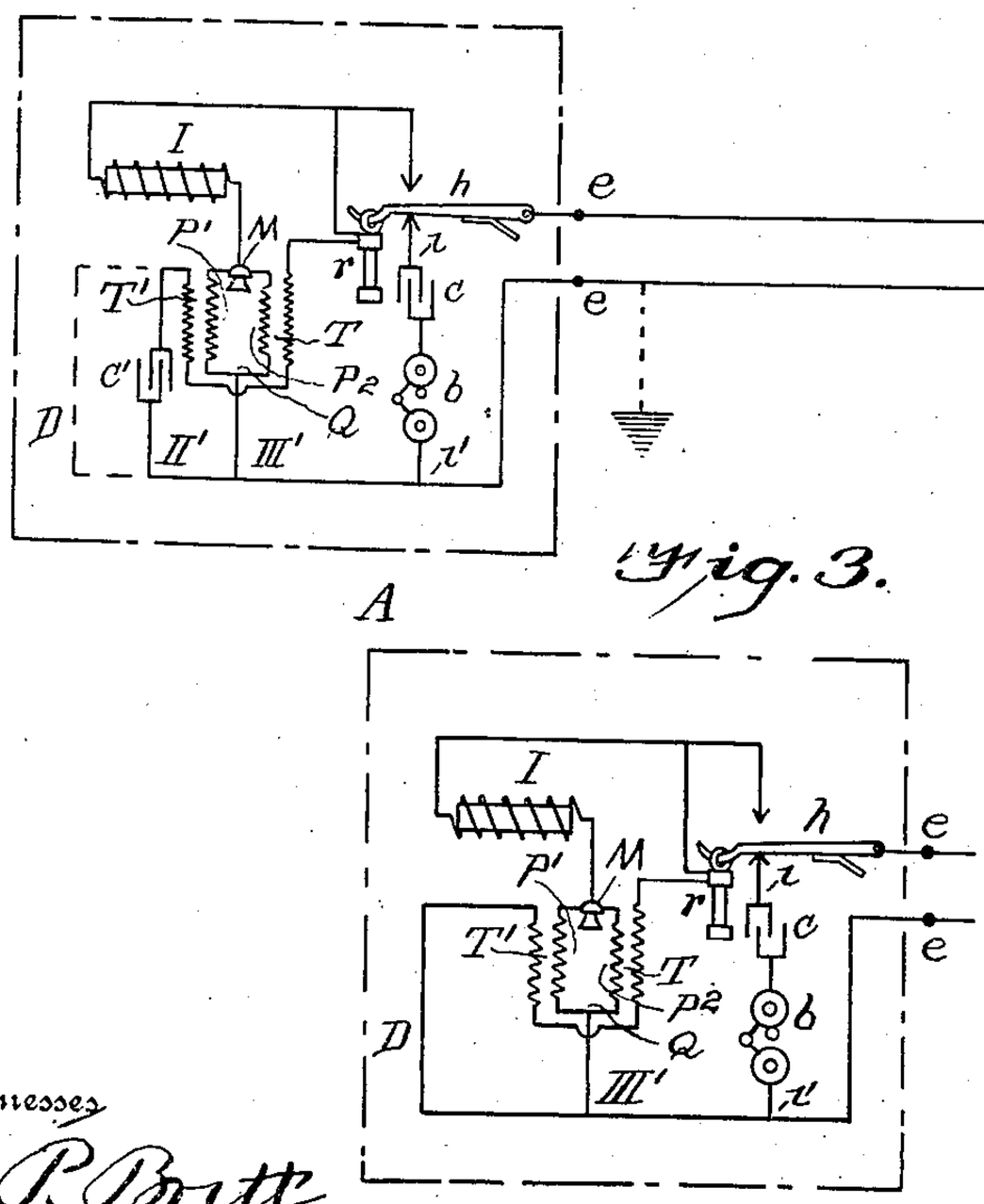


Fig. 3.

Witnesses

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TELEPHONIC TRANSMITTER.

958,561. Specification of Letters Patent. Patented May 17, 1910.

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To all whom it may concern:

Be it known that I, PIETRO STRAGIOTTI, a subject of the King of Italy, residing at Hurley, in the county of Iron and State of Wisconsin, have invented certain new and useful Improvements in Telephonic Transmitters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to the class of telephony, but more particularly to a differential telephonic transmitter and the specific electric wiring therefor; and my invention consists in the application of an autoinduction coil to the differential micro-phone in such manner as to render the micro-phone more efficient and sensitive.

A further object of my invention consists in providing a system in which the constant current necessary to act may be sent from the central to the telephonic line during the time of the communication, and which is at the same time used for a signal in the central.

In other words my invention further consists in providing a system in which the battery circuit feeding the micro-phone, which is usually in the subscriber's box, is in this system made longer, extending from the central to the subscriber's box.

A further object of my invention is to provide a system in which the effective telephonic line resides in the secondary of the transformers which may pass through a condenser, this secondary being a derived circuit of the telephonic box.

My invention also consists in certain other novel details of construction and in combinations of parts, all of which will be first fully described and afterward specifically pointed out in the appended claims.

Referring to the drawings: Figures 1, 2 and 3 illustrate the systems of wiring. Fig. 4 is a view of the differential microphone. Fig. 5 illustrates a modification showing a form of impedance obtained from two identical coils inserted in the two derived circuits.

Referring now to Fig. 1, B is the battery, I is the inductive reactance, and M is the differential micro-phone, T′ and T², the two equal transformers. The current produced by the battery passes through the inductive reactance, goes to the central electrode of the micro-phone where it forks, each branch passing through the primary of a transformer. The primaries are thereby in derived circuits, while the secondaries, (being connected to the same conductor E′ and E²) are in series, so that to any inductive action of the same direction in the two primaries, induction forces of the opposite direction correspond in the secondary from which no induction current corresponds to any equal increasing or diminishing of the current in the two primaries; but when under the influence of the micro-phone the comparative value of the two primary currents changes to the increasing of the one and to the equal contemporary diminishing of the other (which must happen if the inductive reactance I be of sufficient efficiency) then there are induction forces in the secondary which sum together, and a current results in this, proportioned to the variation of the difference which is forming between the two principal currents. By the use of two distinct transformers where the primary currents always flow in the same direction the iron is always magnetized in the same direction and the magnetic permeability is nearly constant allowing a very correct transmission of the wave to the secondary.

The voice vibrations produce a differential variation of resistance in the two parts of the micro-phone, so that if the ideal circuit is considered, which passes through the two parts of the micro-phone and the two primaries of the transformers (where the ohmic resistance is almost wholly in the micro-phones) it is found that under the effect of the vibrations of the central electrode the greatest part of this resistance is oscillating from the right to the left and vice versa of the two symmetrical parts MP′Q and MP²Q synchronically with the sound vibrations, and therefore the greatest part of the current undergoes analogous oscillations in opposite directions. The said oscillations produce currents in the secondary (telephonic) circuit, which are much more energetic than the usual ones, because in this instance the difference of electric tension through the carbon does not change, whence the sparking is diminished, and therefore the current through each micro-phone may be increased. In this inven-

tion the differential micro-phone *per se* is important simply on account of the reason that by its employment this common battery system of telephony is possible.

In the differential micro-phone the total constant current forks in two branches alike in every respect, either corresponding to that portion in the usual micro-phone circuits which comprises a micro-phone and the primary induction coil. So far there is no difference, but in every part of the circuit connected to the micro-phone, the battery included, there flows one and the same current, and therefore to any action of the micro-phone to which a variation of current is to correspond, every part of the circuit counter-acts so as to oppose such variation; while with the differential micro-phone outside of the two branches referred to there flows constant current and nowhere can there arise any such counter-action. It is to be observed that in the carbon micro-phone the only limit in the amount of current is established by the sparking. In the differential micro-phone it cannot be said that no sparking occurs as some reaction cannot be avoided, but it can be relied on that the fact that the reaction above explained does not exist. Consequently with the same amount of current through each micro-phone, as with usual micro-phones, no such amount of sparking will be produced. The action of the micro-phone, therefore, becomes more efficient, because the battery resistance and those extraneous to the micro-phone are of no consequence, and certainty of the action is increased because the action of the two parts of the differential micro-phone is opposite so that not even the faintest sounds of the voice will be lost. This differential micro-phonic apparatus assisted by an inductive reactance allows a peculiar application to telephony by which the central telephonic service is allowed a convenient disposition which obviates some disadvantages usually existing.

Referring now to Fig. 2 which is a diagram of my new system; A represents the subscriber and C the central, A and C being connected by the line, with two wires or with only one wire and the ground. There is a battery of cells or of accumulators B in C which at the same time may serve several subscribers.

From the two points *x*—*x* outside of the battery, the line, especially to each subscriber, starts, which line first passes through the inductive reactance I^c sufficiently effective to avoid any telephonic (talking) current. Two of them are illustrated in Fig. 2, but only one with two suitably disposed windings may suffice. At the central the subscriber's line has also a small lamp L. In *y*—*y* there is a derivation of the two wires to a spring-jack S where the circuit is opened when there is no telephonic communication, but is intended to introduce the service connections. In Q there is the calling button which allows the alternating current from the generator to pass in the line to go to the bell. The line starts from O—O, and the box of the subscriber has in *e*—*e* the connections with the line. When the receiver *r* is hung to the hook *h* the line is closed through *icbi'*, which includes a condenser *c* and the bell *b*. The constant current of the battery B of the central cannot pass because of the condenser *c;* while by means of the calling button Q an alternating current will pass to make the bell act. When the receiver *r* is taken off the hook *h* the circuit through the bell is broken and the two other circuits are introduced; one through the receiver, the secondaries of the transformers and the condenser C′ (instead of which the line D (Fig. 3) may be substituted) to II′, the connecting point with the other circuit. This other circuit passes through the induction reactance I and goes to the central electrode of the micro-phone M where it forks and goes through each of the other electrodes and through each of the primaries of the transformers and thence to the connecting point III′. By introducing these two circuits constant current passes in the line, and therefore the lamp is lighted, which shows the central that the subscriber calls. The whole continuous current passes through the micro-phone M if there is the condenser C′: but when there might be a particular ohmic resistance in the circuit through the receiver and the secondaries of the transformers, the apparatus will act equally well, allowing constant feeble current to pass in this circuit. If this current is a little stronger than the greatest intensity of the telephonic currents it will be sufficient to polarize the receiver which will not need a permanent magnet. When from the central any other subscriber is called and communication with this one is established through the spring-jack S the two subscribers will be in the same condition as to the central, and the telephonic currents originated in the secondaries of the transformers cannot pass in the microphonic circuit III—I—M—III′ nor through the battery B in the central circuit, because of the very strong reactances, so that the said current will run almost wholly in the analogous circuit of the subscriber's receiver. When the telephonic communication is over and the subscribers hang their receivers on the hooks the current coming from the battery is interrupted, because through the spring-jack S only the wires of analogous polarity are connected in order to avoid short circuiting, and the lamp goes out which indicates to the central that the connection must be taken off. With this system of telephony

the local battery of each subscriber is of no use, which is only possible with a differential micro-phone assisted by an inductive reactance, which is an auto induction coil of so strong auto induction that the continuous current passing through cannot undergo any sensible variation.

The principal feature of this application is the use of an auto-induction coil in series with the differential microphone which on this account becomes more efficient as will now appear. The changes of resistance which originate in the two branches of the microphone as well as the induction in the two transformers never compensate each other. The balance acts as to make the main current oscillate while it is intended to remain constant; or in other words, together with the constant current a new oscillatory current flows. If this current divides in the two branches of the microphone into two equal parts no current is originated in the secondaries of the transformers; but as the two branches are never in exactly the same condition this current does not divide into two equal parts, consequently a troubling current is originated in the secondaries together with the telephonic current. The advantages of the auto-induction coil consequently becomes apparent, for by it the current flowing to the central electrode of the microphone is maintained exactly constant thus obviating all troubles. However the combination of an auto-induction coil with a differential microphone is more far reaching than in the simple improvement of this important kind of microphone, for the reason that this combination offers a simple and practical system of common battery telephone as has previously been explained.

To describe more in detail its operation, let us consider the circuit through the secondaries and the receiver which is connected at II′ and III′ with the line conductors. Therefore at II′ and III′ this circuit forks in two derived circuits; one through the microphone and the primaries of the transformers and the other through the line to the central, consequently the talking current generated in the secondaries divides into two parts inversely proportionate to the respective resistances. If the microphone had not been joined with an auto-induction coil the resistance of this derived circuit would be relatively very small as compared with the line and therefore a very small fraction of the telephonic current would flow through the line, but with the auto-induction coil the microphonic circuit becomes insensible to the telephonic current, and so no other path is offered to this current but the line to the central. In the same manner, when this talking current reaches *y*—*y* at the central two derived circuits are again formed, one through the spring-jack to the subscriber to be connected, and the other through the battery, but this latter is rendered insensible by the auto-induction coil I^c.

If the telephonic current is considered which flows through the spring-jack from the other subscriber to be connected, this current flows along the line to the points II′ and III′ of the subscriber's box A to go practically in its entirety through the receiver as no other derived circuits are offered to this current because of the auto-induction coils that render insensible the circuit through the battery and the circuit through the microphone. The result is that the actual telephonic circuit, that is, the circuit through which a telephonic current may flow establishes by the line the circuit through the receivers in two subscribers' boxes and their connections through the spring-jacks at the central.

Referring to Fig. 5 it will be seen that I illustrate a form of impedance obtained from two identical coils inserted in the two derived circuits, but this form does not differ substantially from the impedance coil of Figs. 1 and 2, as not only this arrangement can be substituted for that but from the latter construction it is easy to obtain this form by establishing connections in Q, Q, for an impedance is then made of one coil with double wire.

Having thus fully described the several parts of my invention what I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination with a telephonic line, of a bridge-circuit comprising a differential micro-phone in series with an impedance coil.

2. The combination with a telephonic line, of a bridge-circuit comprising an impedance coil in series with a differential micro-phone where said bridge-circuit forks in two derived circuits.

3. The combination with a telephonic line, of a bridge circuit comprising a differential micro-phone where said bridge-circuit forks in two derived circuits, each passing through one of two identical coils wound on the same core and acting together as to produce an impedance on the total current that flows through said differential micro-phone.

4. The combination with a telephonic line, of two local parallel circuits, the first passing through a receiver, the secondaries of transformers and a condenser; and the second through an impedance coil and a differential micro-phone where said second parallel circuit forks in two derived circuits passing through the primaries of said transformers.

5. The combination with a telephonic line, of two local parallel circuits of relatively high ohmic resistance passing through a receiver and the secondaries of transformers,

and the second through an impedance coil and a differential microphone where said second parallel circuit forks in two derived circuits passing through the primaries of said transformers.

6. The combination with a telephonic line, of three parallel local circuits, the first through a receiver the secondaries of transformers and a condenser; the second through an impedance coil and a differential microphone where said second parallel circuit forks in two derived circuits passing through the primaries of said transformers; the third through a condenser and a polarized bell, and means by which said third circuit is connected to said telephonic line.

7. The combination with a telephonic line, of three parallel local circuits, the first through a receiver the secondaries of transformers and a condenser, the second through an impedance coil and a differential microphone where said secondary parallel circuit forks in two derived circuits passing through the primaries of said transformers, the third through a condenser and a polarized bell, and means by which said first and second circuits are connected to said line.

In testimony whereof, I affix my signature, in presence of two witnesses.

PIETRO STRAGIOTTI.

Witnesses:
C. M. FORREST,
C. HUGH DUFFY.