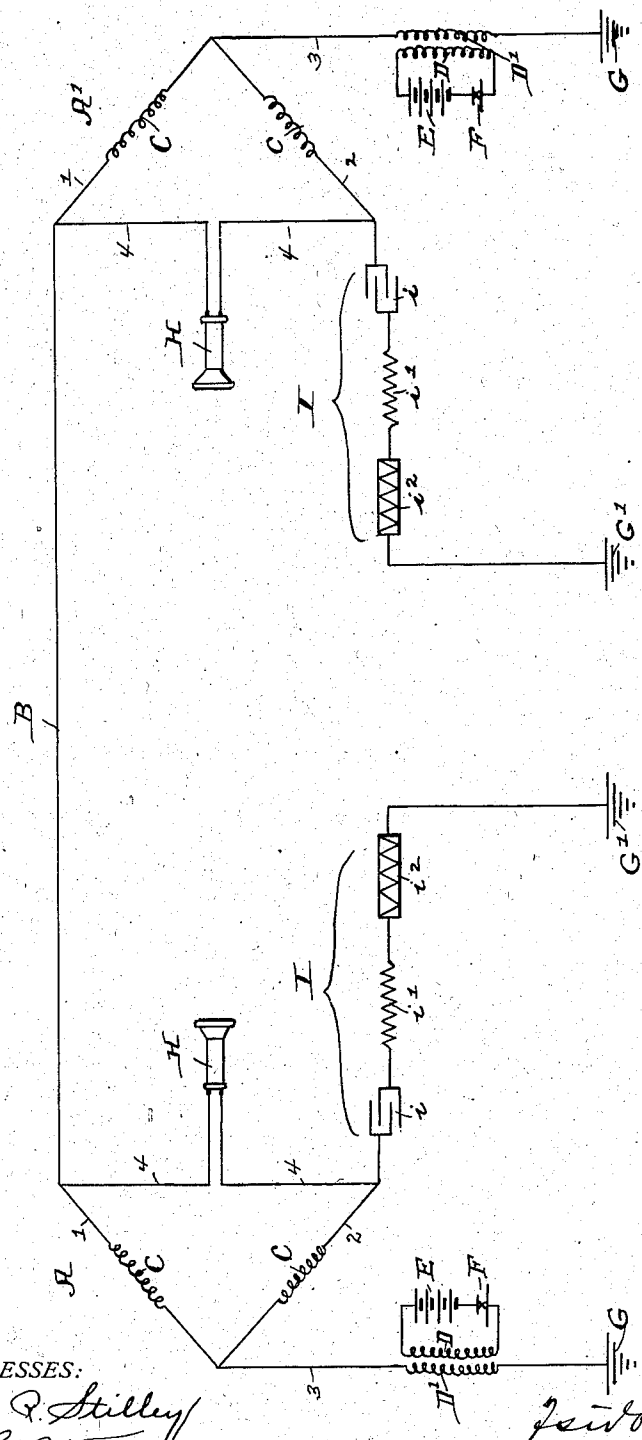
No. 824,030. PATENTED JUNE 19, 1906.

I. KITSEE.

TELEPHONY.

APPLICATION FILED JULY 23, 1904.



WITNESSES:

Edith R. Stilley

H. C. Yetter

INVENTOR.

Isidor Kitsee

UNITED STATES PATENT OFFICE.

ISIDOR KITSEE, OF PHILADELPHIA, PENNSYLVANIA.

TELEPHONY.

No. 824,030. Specification of Letters Patent. Patented June 19, 1906.

Application filed July 23, 1904. Serial No. 217,824.

To all whom it may concern:

Be it known that I, ISIDOR KITSEE, of the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Telephony, of which the following is a specification.

My invention relates to an improvement in telephony, and has more special reference to the arrangement of the telephonic devices in the transmitting-line.

In long-distance transmission the self-inductance, capacity, and resistance of the line greatly retard the transmission of speech, and notwithstanding all improvements made heretofore in such transmitting-line long-distance transmission is still inadequate for practical purposes. More so is this the case where only one line is employed and the ground is used as a return. To the retardation and distortion of the double line must in a single line be added the inductive influence of the neighboring wires, as well as the difference of potential of the ground near the terminals, and it can be said that whereas the electrical properties of the line itself greatly retard the sound-waves the inductive influence and the difference of potential of the ground drown the waves generated by the transmitting device, for the reason that the waves of the external disturbances overreach in strength the weak waves generated by the telephonic transmitting device. To overcome these difficulties in the one-line transmission, I had recourse to various devices in which the generated impulses were capable of inducing secondary impulses of unusual high potential, and to do this it was necessary to have the secondary of a very large number of turns of very fine wire. In fact, I produced devices in which the secondary consisted of several thousand turns of No. 40 wire.

In some of my experiments in which I used a one-line conductor connecting two cities about two hundred and fifty miles apart I employed such high-wound inductoriums; but whereas I was able to drown all the "inductive noise" on the line from the ground, as well as from neighboring wires, and whereas the speech could be distinctly heard at the receiving-station if only an ear-phone was inserted in the line at that station speech could not be distinguished if alike high-wound inductoriums were inserted at both ends of the line. These experiments were repeated on an overhead line of greater length than above and with alike results, showing that the generated high impulses are capable of overcoming resistance, capacity, and self-inductance of the line, as well as inductive influence from neighboring lines or the ground, but that they cannot overcome the resistance and inductance of the high-wound coil.

If at one of the stations the secondary was shunted when the speech was transmitted from the other station, and vice versa, communication could be carried on between these stations, and the speech was distinct and clear; but as soon as the shunting was omitted no speech could be heard in the receiver. The fact that the roaring noise heard through the receiver connected in series to the grounded circuit depends to its greatest extent on the condition of the ground, and that the length of the line has scarcely any influence on this noise, may not be generally known, but careful experiments have proven such to be the case.

In one of my experiments a line of eight miles was employed. This line was in part carried through cables partially underground and partially submarine. The remainder (about four miles) was aerial. The ground was in proximity to the grounds used for telegraphic lines. The volume of noise was such that conversation could not be carried on between one and the other terminals of these lines. To find out if this noise was caused by the line itself or the ground, or both, the grounded part was connected directly to a telephonic receiver and only about one-half mile of the line connected to the free terminal of said receiver. The noise was not diminished at all, and even after that half-mile was disconnected the noise only decreased a trifle, thus proving that this interference with the transmission of speech is conditioned to the greatest part only on the ground and is taken up by the terminals of the line in contradistinction to the electrostatic induction, which, as is well known, causes the disturbing influence to move from the middle toward the ends of the line. It was also proven in these experiments that an impedance or even a resistance *per se* is capable of reducing the what I call "ground disturbance" if such impedance or resistance is inserted between the ground and the receiver, and, further, these experiments have proven that the line, especially if the same is of comparative high resistance, acts in the same manner as the impedance or resistance inserted between the line and the ground

acts, for when the single line was connected to a second wire—that is, when a metallic circuit was formed and connected only on one side to the ground—the roaring noise could be heard well at the grounded wire; but it could be heard only faintly at the other end, where no ground was present.

To overcome the difficulty experienced in a telephonic single line grounded at both ends, it is necessary to arrange the receiving instrument in a manner so that between them and the ground devices are placed absorbing the noise due to the ground, and to do this I have devised an arrangement substantially as illustrated in the drawing, in which is illustrated in diagrammatic view a telephonic circuit embodying my improvement.

In the drawing, A A′ are two telephonic stations, each equipped with a transmitting and a receiving instrument. These stations are connected together through the line B. Each station consists of the grounded transmitter, preferably embracing, as is illustrated, the microphonic transmitter F, source of current E, primary D of an inductorium, connected locally to each other. The secondary D′ of this inductorium is connected with one terminal to the ground and with the other terminal to the wire 3. This wire is connected to the junction of the wire 1 and 2. Each of these wires has an equal resistance and is provided with the device C. These two wires are overbridged by wire 4 and have connected thereto in series the receiver H. To the junction of wire 1 and wire 4 at each station is connected one of the terminals of the line B. To the junction of the wires 2 and 4 are connected devices which make it possible for the operator to duplicate the electrical conditions of the line B, and these devices are designated as an entirety by the letter I, and consist, preferably, of condenser i, resistance i', and impedance i^2. These devices are grounded at G′.

I will state that I used in some of my experiments a transmitting device wherein the secondary was of such high impedance that no speech could be transmitted through same when inserted in the line in series. The advantages of this arrangement for telephonic communication over a grounded single line are: First. An inductorium of very high intensity can be used without choking the line. Second. As at the one station transmitted impulses will divide in equal proportion over the branches 1 and 2, it is obvious that the same will not operate the home receiver, and it is also obvious that in operating the receiver at the distant station these impulses have to travel over the line, which, as stated above, acts in part as a resistance inserted between the ground and the receiver at the local station, so that the impulses arriving at the distant station will be minus the roaring sound which emanates from the ground. It may be further stated that careful experiments were made with this arrangement, and whereas is was impossible to telephone over the line with the arrangement as commonly used it was found that hardly any noise due to the ground connection could be distinguished in any of the receivers connected in accordance with my invention.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a system of telephonic transmission, two stations connected together through a single conductor, each station provided with transmitting and receiving instruments, the transmitting instrument consisting of a microphonic transmitter, a source of current and an inductorium, one part of said inductorium locally connected to said source and transmitter and one part of said inductorium connected to the ground and to the line with the interposition of two branches of substantially equal resistance, the telephonic receiver overbridging said branches, one terminal of said branches connected to the line proper and one terminal of said branches connected to devices adapted to duplicate the electrical conditions of said line, said devices also grounded.

2. A telephonic system comprising a line connecting two stations with each other, each station organized as follows: two arms of a bridge, one arm connected to the line proper and the other arm connected to an artificial line of, electrically considered, about the same value as the main line, each arm of the bridge provided with a resistance, the receiver connected across the bridge-arms, the junction of said bridge-arms connected to the secondary of an inductorium, the primary of said inductorium connected locally to a transmitter and source of current.

3. As a means to overcome the inductive noise of the ground on a telephonic line of transmission, two conducting branches connected to the line and ground respectively, a telephonic receiver, said receiver overbridging said branches, and a telephonic transmitter connected to the junction of said branches and ground.

4. In telephony, a line of transmission connecting together two stations more or less remote from each other, one or both of said stations provided with a telephonic transmitter connected at one terminal to the junction of two wires of substantially equal resistance, a receiver overbridging said branches and resistances connecting one terminal of said receiver to the ground.

5. A system of telephonic communication embracing two stations connected together through a conducting-line, each station embracing a microphonic transmitter, a source of current and an inductorium, the secondary

of said inductorium connected with one terminal to the ground and with the other terminal to the junction of two circuit branches, each station also provided with a telephonic receiver overbridging said branches and means to produce an artificial line.

6. A telephonic system comprising two stations connected together to a line of transmission, each station embracing two bridge-arms, a telephonic receiver across said bridge-arms and a telephonic transmitter operatively related to the junction of said bridge-arms.

7. In combination with a one-line telephonic circuit grounded at two stations more or less remote from each other, a bridge connected with one terminal of one arm to the line and with one terminal of the second arm to the ground; the free ends of said two arms connected with the interposition of the secondary of an inductorium to the ground, and a telephonic receiver overspanning the arms of said bridge.

In testimony whereof I hereby sign my name, in the presence of two subscribing witnesses, this 21st day of July, A. D. 1904.

ISIDOR KITSEE.

Witnesses:

H. C. YETTER,

EDITH R. STILLEY.