No. 686,228. Patented Nov. 5, 1901.

I. KITSEE.

TELEPHONY.

(Application filed Feb. 20, 1896. Renewed Mar. 1, 1901.)

(No Model.)

FIG. 1.

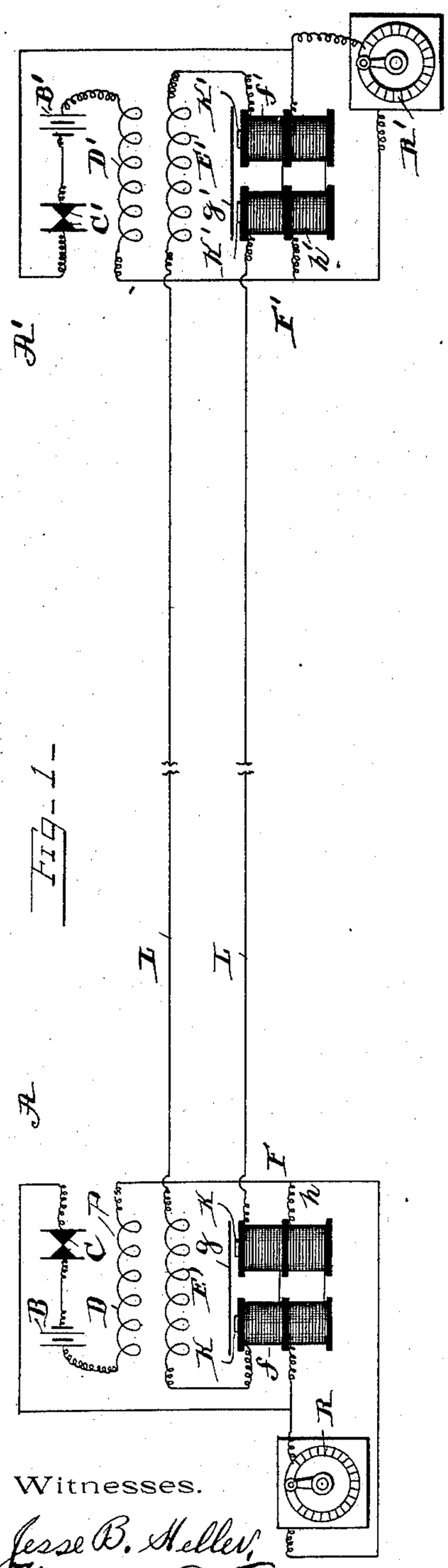

FIG. 2.

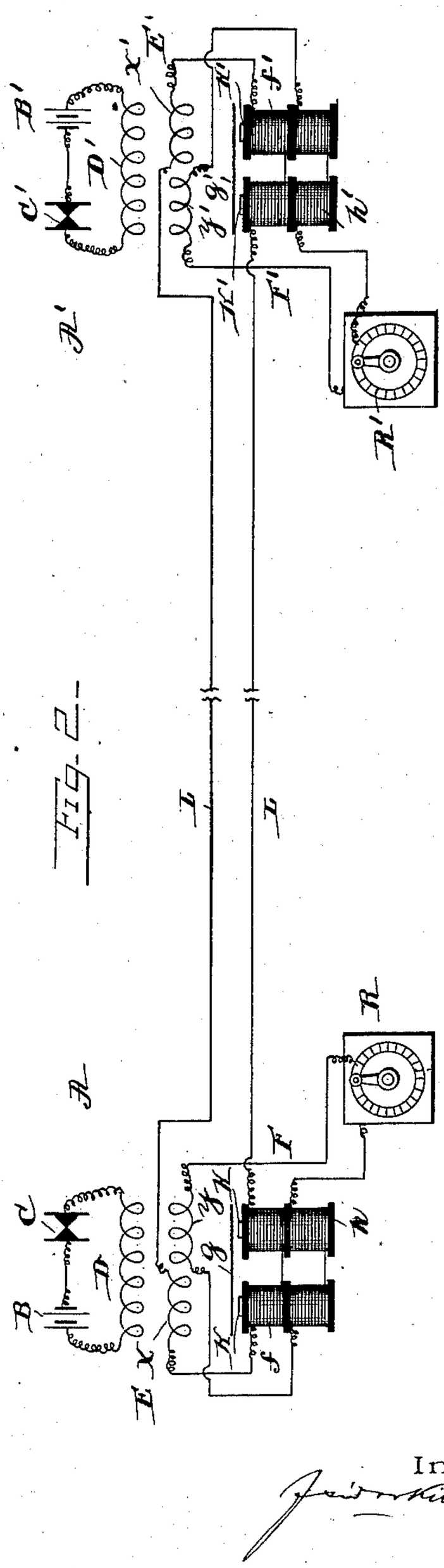

FIG. 3.

FIG. 4.

Witnesses.

Jesse B. Keller,

Walter B. Eldridge

Inventor:

Isidor Kitsee

UNITED STATES PATENT OFFICE.

ISIDOR KITSEE, OF PHILADELPHIA, PENNSYLVANIA.

TELEPHONY.

SPECIFICATION forming part of Letters Patent No. 686,228, dated November 5, 1901.

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To all whom it may concern:

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

My invention relates to telephony, and has for its object to increase the capacity of a telephonic circuit by the simultaneous transmission of speech in opposite direction over one and the same line-wire—in other words, to produce a duplex, or, as the simultaneous transmission of two messages in opposite directions is sometimes called, a "contraplex" telephonic system.

Referring to the drawings, Figures 1 and 2 are electrical diagrams of telephonic systems embodying my invention.

In illustrating the sending and receiving devices I have left out all mechanical details as not pertinent to the case and have only represented this instrument by the usual conventional signs, it being understood that the electrical arrangements are the only ones to be considered in connection with this application.

This system is more specially adapted for the purpose of transmitting news from one center to the other. At each station two persons are present. One person transmits the message from station A to station A′, one person receives the message at station A′, one person transmits the message at the same time from station A′ to station A, and one person receives the message at station A. Each station is equipped with a sending and receiving instrument, substantially as illustrated in the drawings. Both figures are electrical diagrams illustrating each two stations connected together by metallic line-wire. Each of these stations is provided with a transmitter and with a receiver. The transmitter is in both figures of the usual type; but the electromagnet of the receiver is provided with two coils, one coil connected electrically to the line-wire and one coil connected locally, so as to nullify the effects of the home-transmitter on the home receiving instrument, as will hereinafter be more fully set forth.

I will first explain the working of the system as illustrated in Fig. 1. In this figure, L is the line-wire connecting the two stations A and A′. As most of the long-distance telephonic lines are metallic throughout, I have illustrated my invention as applied to such metallic circuit; but it is obvious that this arrangement can also be applied to lines with ground connections. Similar parts of station A′ are designated by similar letters as in station A, with the exception that these letters are also provided with the numeral 1. C is the microphonic transmitter connected to one pole of the battery B and through it with the primary coil D. F is the receiver, of which *f* is the electromagnetic part, connected in series to the secondary coil E and line-wire L, respectively. This electrical arrangement is a counterpart of the electrical arrangement as usually employed in telephony, all mechanical appliances to open or close the circuit between battery B and microphonic transmitter or between receiver F and line-wire L being for the sake of brevity omitted; but the first condition to be fulfilled in carrying out the method of simultaneous transmission of two telephonic communications in opposite direction is that the receiving instrument at the home station shall remain entirely unaffected by the impulses induced through the home transmitter, while at the same time it shall remain free to respond to the impulses induced through the microphonic transmitter at the distant station. It is therefore necessary to bring the home receiver in such electrical relation to the impulses generated at its own station that the same should leave it entirely passive. I accomplish this result through the employment of the coil *h*, connected to the primary circuit inclosing the transmitter C. The coil *h*, which is wound around the same core of the receiver F as is the coil *f*, is connected to the circuit in a manner so that the flow of the current through this coil will energize the core in opposition to the current-flow in the coil *f*. The resistance R is placed into the circuit so as to be able to regulate the flow of the current through the coil *h*. If, therefore, the microphonic transmitter C is actuated, the electrical effects on the transmitter are as follows: Through the vibration of the diaphragm of C the current strength varies in the coil D, inducing impulses in the coil E, which impulses flowing through coil *f*

actuate through their varying effect on the core *k* the diaphragm *g;* but as at the same time the current-flow through coil *h* is also varied, and these variations affect the core *k* oppositely from the effects of the current variation in coil *f*, it follows that the added effects of both the coil *f* and *h* on the core *k* are null. Supposing now that the station A communicates with station A′, the effect of the generated induced impulses in E on the home receiver will be nullified through coil *h*, but they will flow over the line-wire through the coil E′ at the distant station or station A′ and the coil *f′* of the receiver F′, the coil *h′* being left unaffected. The varying impulses, therefore, will cause a variation in the magnetic condition of core *k′* and the diaphragm in *g′* will therefore respond. If the station A′ communicates at the same time with the station A, one of two electrical conditions will occur. Either the induced impulses in both of the coils E and E′ are simultaneously flowing in opposite directions, when they will oppose each other, their magnetizing effect on the cores *k* and *k′* will be nullified, and these cores will therefore be free to change their magnetic conditions in accordance with the electrical variations set up in coils *h* and *h′*, or the electrical impulses induced in the coils E and E′, respectively, will flow simultaneously in like directions. Then they will multiply each other, and as their multiplied effect is greater on cores *k* and *k′* than the effect of coils *h* and *h′* the magnetic condition of the two cores will vary according to the variations of the current flowing through *f* and *f′*.

In Fig. 2 the neutralization of the home receiver is not, as in Fig. 1, effected through the variation of the flow in the primary circuit. The opposing coil is placed in the secondary circuit and connected in such manner that the magnetic effect of the induced impulses in the opposing coil is opposite to the effect produced in the coil *f*. To this end the coil E is divided in two parts, of which X is the part connected through coil *f* to the line-wire, and *y* the part connected through rheostat R to the opposing coil *h*. The electrical conditions arising when either A alone or A and A′ simultaneously are speaking are the same as those pointed out above. In practice the part of the double secondary E, connected to the opposing coil, does not need to be as large as the part connected through *f* to the line. It is best that the rheostat R, having the function to balance the influences of the two coils *f* and *h* upon the cores *k*, be tested every day. To do this, the operator at the office A simply calls up the person at office A′, and if his home receiver does not respond to his call then the coils are balanced correctly; otherwise he has to establish such balance through the operation of the rheostat, with the aid of which more or less resistance may be thrown in the circuit of the coil *h*. If necessary, a condenser may be placed either in series with the coil or in shunt to the same, the office of condensers in balancing an artificial line being well understood.

The arrangement as illustrated in Fig. 1 embraces, as explained above, the employment of the primary current as an equalizer, but in my experiments I have found that the arrangement as illustrated in Fig. 2 is better adapted for long-distance transmission, and is therefore to be preferred. With it it is an easy task to adjust the flow of currents in both coils *f* and *h*, so that they will exert an equal and opposing effect on the cores K. With the arrangement as illustrated in Fig. 1 such adjustment is more complicated.

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

1. In a contraplex system of electric transmission, a sending device and receiving device, consisting of a microphonic transmitter, a source of current, an induction-coil, one of the coils of said induction-coil being connected through the line-wire to a second station, and the other locally to the transmitter and the receiving device.

2. In a duplex system of telephonic transmission, two or more stations, each station being equipped with sending and receiving instruments, the sending instrument consisting of a microphonic transmitter, a source of energy, and the primary of an inductorium, one part of the secondary of which is connected to the line-wire and the other part of said secondary is being connected locally to the receiving instrument.

In testimony whereof I sign my name, this 17th day of February, 1896, in the presence of two subscribing witnesses.

ISIDOR KITSEE.

Witnesses:
WALLACE B. ELDRIDGE,
GEO. M. COSTELLO.