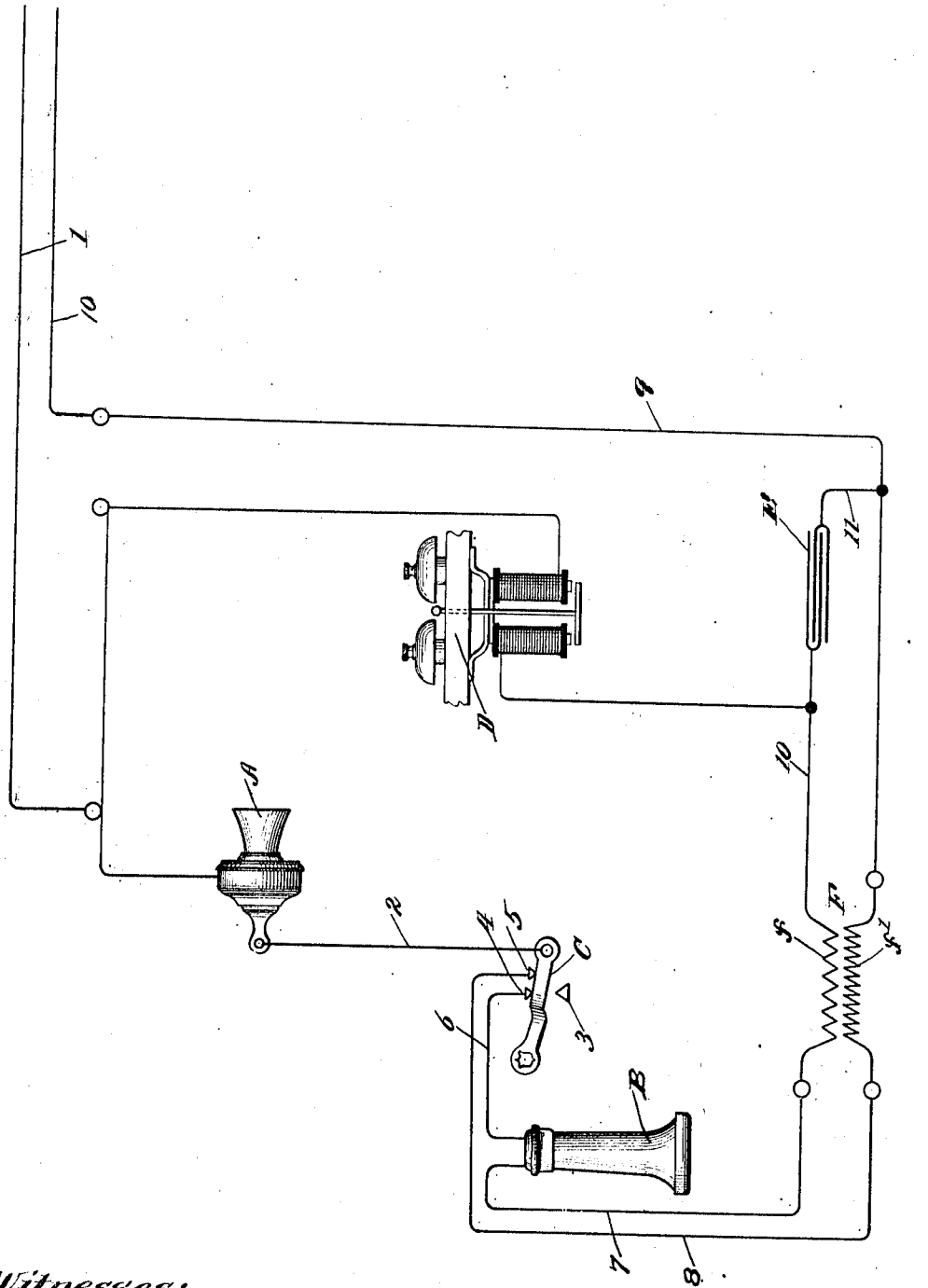
H. P. CLAUSEN.

TELEPHONE APPARATUS.

APPLICATION FILED MAR. 11, 1903.

1,035,158. Patented Aug. 13, 1912.



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UNITED STATES PATENT OFFICE.

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TELEPHONE APPARATUS.

1,035,158. Specification of Letters Patent. Patented Aug. 13, 1912.

Application filed March 11, 1903. Serial No. 147,322.

To all whom it may concern:

Be it known that I, HENRY P. CLAUSEN, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Apparatus, of which the following is a specification.

My invention contemplates a highly efficient circuit arrangement for the instruments involved in an ordinary telephone set, such, for example, as a subscriber's telephone apparatus, and is designed to have a quieting effect upon the circuit, and to more effectually prevent disturbances and agitations in the receiver, the principal object and purpose of the invention, more technically speaking, being to cut down what are commonly known as "side tones" in the receiver.

To the foregoing and other useful ends, my invention consists in matters hereinafter set forth and claimed.

The accompanying drawing is a diagram illustrating my improved circuit arrangement as applied to the apparatus or instruments and devices involved in an ordinary subscriber's telephone set.

It will be readily understood that the principles and valuable features of my invention are applicable to telephone transmitters and receivers at any and all places in a telephone system, and in any and all connections or situations where it may be desirable or necessary to improve the operation of these instruments.

In the accompanying drawing, which illustrates one embodiment of my invention, the transmitter A may be of any suitable known or approved construction. The telephone receiver B can also be of any suitable or desired character, and can be associated with an ordinary pivoted switch-hook C. The bell or ringer D and the condenser E may be likewise of any suitable form or construction. The induction coil, F, however, is preferably, though not necessarily, of a character hereinafter set forth and described. In the said diagram, the line conductor 1 preferably leads to one terminal of the said transmitter, the other terminal of the latter being connected with the hook-switch through the medium of the conductor 2. Normally, the hook-switch rests upon the stop 3, and for this reason the two contacts 4 and 5 are normally open and not in engagement with the said hook-switch. One terminal of their receiver is preferably connected with one terminal of the secondary winding *f* of the said induction coil, while the other terminal of the said receiver is preferably connected with the contact 4. A conductor 6 may serve as the medium of connection between the contact 4 and the receiver, and a conductor 7 may serve as medium of connection between the receiver and the secondary of the induction coil. The contact 5 may be, and preferably is, connected with one terminal of the primary winding *f'* of the induction coil, through the medium of the conductor 8. The other line conductor 10 is preferably connected with the other terminal of the primary of the induction coil through the medium of a conductor 9, and also with the other terminal of the secondary of the induction coil through the medium of the said condenser and the conductors 10 and 11. The said bell or ringer D is in a bridge across the line, preferably including the said condenser.

The resistances of the various coils and windings can be carried or changed to suit the conditions of any particular case. Under ordinary conditions, however, I find that a bell of 1000 ohms resistance is preferable, and that a primary winding of 21 ohms resistance and a secondary winding of 9 ohms resistance, the secondary winding having only one turn to every three turns of the primary winding, give very satisfactory results. The condenser is preferably of two microfarads.

Thus it will be seen that when the apparatus is in use, as shown in the drawing, the condenser, the secondary of the induction coil, the receiver, the hook-switch, and the transmitter, are connected in series. Furthermore, at such time, the primary of the induction coil is in a shunt or parallel connection extending around the condenser, the secondary of the induction coil, and the said receiver. This arrangement I find to be very effective in quieting the apparatus and preventing disturbances in the receiver.

The novel method of connecting up the induction coil, receiver, and condenser, appears to give a reactionary effect, so to speak, which permits the subscriber to talk into the transmitter without producing ob-

jectionable disturbances and noises in the receiver. In other words, my improved circuit arrangement for a telephone set tends to very materially cut down disturbances and what are commonly called "side tones" in the receiver.

As shown in the accompanying diagram, the primary and secondary of the induction coil F may be wound in the same direction. I have used this arrangement, and find it effective in cutting down side tones in the receiver. As far as cutting down side tones is concerned, the direction and mode of winding are, however, unimportant, and may be varied without departing from the spirit of my invention. It will be seen that the transmitter A is disposed in position for an efficient transmitting action, being in shunt only of the ringer D. Furthermore, it will be seen that the receiver B is entirely excluded from the path of battery current, although in series with the transmitter. The primary and secondary of the transformer F are both included in the talking circuit, but only the primary is included in the battery circuit over which current flows through the transmitter. In other words, the condenser E stops the flow of battery current through the secondary and the receiver, but permits the voice currents coming over the line from the other subscriber to pass through the said receiver. During use of the transmitter A the fluctuating battery current passes entirely around the receiver, and any side tones or stray voice currents, produced by the said transmitter, which may attempt to pass through the receiver at such time are interfered with by the secondary or alternating current generated in the secondary coil *f* of the induction coil or transformer. In order words, the transformer action between the two windings interferes with the condenser action, as the alternating current in the path 10 is not in step with the charging and discharging of the condenser caused by the variation of current in the path 8 and the line. This interference is sufficient to greatly modify or reduce the side tones in the receiver, and consequently the user of the transmitter A is not annoyed by unpleasant sounds in the receiver B when he speaks into the former. As explained, the receiver and transmitter are connected in series in the line circuit, but at the same time the receiver is effectually excluded from the path of battery current, and the transmitter is not in shunt of anything except the ringer D, which latter is preferably of high impedance to prevent the passage of voice currents therethrough, and of sufficient resistance to prevent shunting of the battery current around the transmitter. There is, of course, an impedance winding or coil or inductive resistance in shunt of the receiver, but it will be seen that the winding in series with the receiver is fully and closely inductively related to the said impedance coil or inductive resistance, and that consequently sufficient interference takes place to materially retard the flow of voice currents through the said receiver during the time that the subscriber is speaking into the associated transmitter A. As stated, the condenser E prevents a flow of battery current through the receiver B, and at the same time the capacity of this condenser coöperates with the impedance of the coil *f'* in causing the voice currents coming over the line from the other subscriber to pass through the receiver B, rather than around the latter. The arrangement, however, is such, it will be seen, that the fluctuating battery currents produced by the microphone transmitter A are calculated to pass readily through the winding *f'*, these currents being direct, whereas the voice currents coming over the line from the other subscriber are alternating in character. Thus, as I have already explained, my improved arrangement effectually excludes the receiver B from the battery current, materially cuts down side tones in the receiver, and at the same time leaves the latter in position to serve as an efficient receiving instrument for listening to the speech of the other subscriber.

I claim as my invention:—

1. The combination of a suitable transmitter, a suitable receiver, a suitable hook-switch, an induction coil having a primary winding of substantially 21 ohms resistance and a secondary winding of substantially 9 ohms resistance, the said secondary winding having one turn to every three turns of the primary winding, a condenser of substantially two microfarads, a bell having coils of substantially 1000 ohms resistance, a subscriber's line across which the said bell and condenser are bridged in series, suitable contacts and circuit connections whereby the removal of said receiver from said hook-switch temporarily connects the said condenser and secondary winding and receiver and transmitter in series in the line circuit, and whereby such removal of the receiver also operates temporarily to place the said primary winding in a parallel connection extending around the said condenser and secondary winding and receiver, said receiver thereby unaffected by current in the said primary.

2. A telephone circuit having two parallel paths, one of said paths including only a primary transformer winding and the other path including a condenser serially connected in circuit with a telephone receiver and the secondary of said transformer, said secondary winding having substantially one turn to every three turns of the said primary winding, and means for establishing a

direct current in the said primary without affecting said receiver thereby.

3. In combination, a telephone transmission line, a source of current and a telephone transmitter serially included in the main line, an induction coil included in said line and having a primary and a secondary winding connected in parallel with each other and included serially in the line with said transmitter, one of the parallel branches serially including a condenser and receiver in circuit, said secondary winding being of less resistance than the said primary winding, and a circuit whereby current flowing in the primary and transmitter does not pass through or affect the said receiver.

4. In a substation telephone set, the combination with a primary winding of an induction coil and a transmitter connected serially together in bridge between the line limbs of the telephone circuit, a shunt circuit about the primary winding only, said shunt circuit serially including a condenser and a receiver and the secondary winding of the induction coil, a signal bell connected in bridge of the line limbs through said condenser, and a circuit whereby current flowing in the primary and transmitter does not pass through or affect the said receiver, said secondary winding having a less number of turns than the said primary winding, the primary winding being of greater resistance than the secondary winding, and said signal bell being of high resistance.

5. A telephone circuit having two parallel paths, one of said paths including only a primary transformer winding and the other path including a condenser serially connected in circuit with a telephone receiver and the secondary of said transformer, said primary affording a path whereby no battery current that passes through the transmitter is permitted to flow through any part of the receiver, and said primary and secondary being wound inductively one upon the other.

6. In combination, a telephone transmission circuit, a source of current and a telephone transmitter serially included in the main circuit, an induction coil included in said circuit having a primary and a secondary winding connected in parallel with each other and included serially in the circuit with said transmitter, one of the parallel branches serially including a condenser and receiver in circuit, said primary affording a path whereby no battery current that passes through the transmitter is permitted to flow through any part of the receiver, and said primary and secondary being wound inductively one upon the other.

7. In a telephone system, a line circuit, and a pair of substation coils connected in parallel in said circuit, said coils being disposed with their end convolutions in the same planes, and having parallel axes.

Signed by me at Chicago, Cook county, Ill. this 6th day of March 1903.

HENRY P. CLAUSEN.

Witnesses:

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