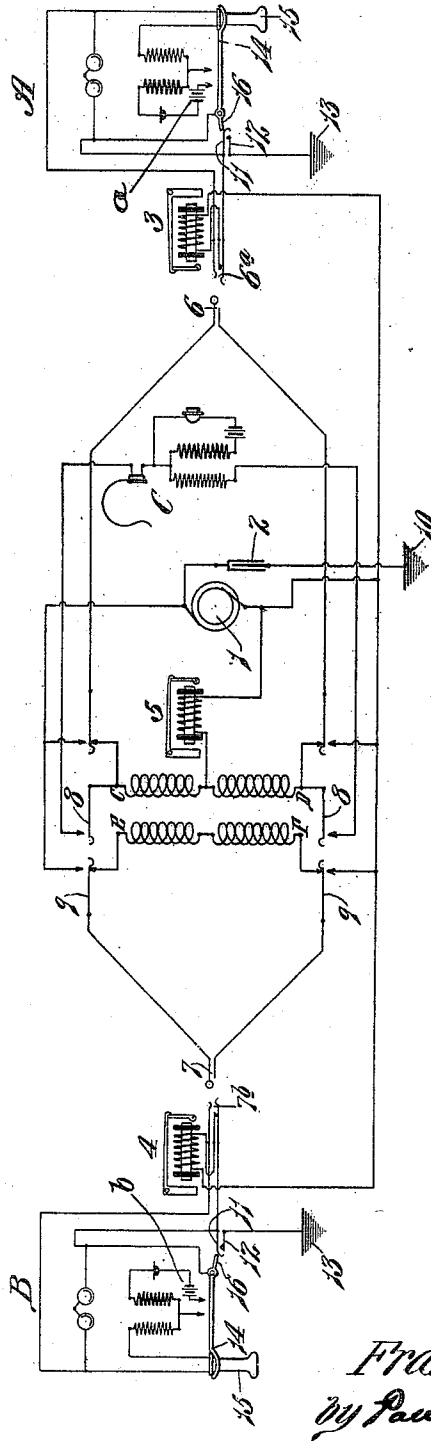


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 TELEPHONE SYSTEM.
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Patented Jan. 31, 1911.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, FRANK C. UNGER, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to telephone systems, and particularly to local battery or magneto telephone systems such as have heretofore been in general use in small towns and in the country.

In a magneto telephone system each subscriber's telephone is provided with a generator or ringing machine that the subscriber has to turn or actuate in order to operate his line-drop at the central exchange which notifies the operator that the subscriber desires to talk to another subscriber. After the conversation is completed the subscriber who originated the call also has to operate the generator or ringing machine on his telephone so as to operate the clearing-out drop at the central office which notifies the operator that the conversation is completed.

One object of my present invention is to provide a local battery telephone system of improved design which eliminates the expense of equipping the telephone of each subscriber with a ringing machine, generator or kick coil, and which also overcomes the necessity of requiring the subscriber to actuate a device on his telephone when he desires to call the operator at the central exchange or when he has completed his conversation with a different subscriber.

Another object is to provide a telephone system of the type above referred to which is so designed that the clearing-out drop at the central exchange will not operate automatically and thus give the operator a false signal when the called subscriber takes the receiver of his telephone off the supporting hook to answer a call.

Another object is to provide a telephone system which is so designed that the inductive disturbance from one line to another line connected thereto is reduced to a minimum.

Other objects and desirable features of my invention will be hereinafter pointed out.

The figure of the drawings is a diagrammatic view of a telephone system construct-

ed in accordance with my present invention.

Briefly described, my invention consists in a telephone system in which the telephones of the different subscribers are provided with individual batteries or other suitable devices for operating the transmitter circuits, and the central exchange is provided with a separate and distinct source of electrical energy for signaling purposes. In view of the fact that the source of energy use for signaling purposes is separate and distinct from the energy that operates the transmitter circuits of the subscribers' telephones, it is possible with my improved system to use either a direct or alternating current generator at the central exchange for signaling purposes because any noise or variation in the signaling circuit has no effect on the transmitter circuits of the subscribers' telephones.

In the embodiment of my invention herein shown, alternating current is used for signaling purposes but I do not wish it to be understood that my invention is limited to such a system for, if desired, direct current could be used for this purpose. I prefer, however, to use alternating current for the reason that alternating current is better adapted to long lines than direct current. That is to say, where direct current is used for signaling purposes, as in the well-known direct current central energy system, it is necessary to limit the line to a mile or two long; whereas, with alternating current it is practicable for signaling purposes to use a much longer line and thus overcome the necessity of having several branch exchanges such as are generally used in telephone systems in large cities or thickly populated districts.

Referring to the drawing which illustrates a telephone system embodying my present invention, A and B designate two subscribers' telephones whose transmitter circuits are operated by local batteries *a* and *b*, respectively, and C designates the operator's telephone at the central exchange. A signaling machine or ringing machine which may consist of an alternating or pulsating current generator or pole-changer 1, is arranged at the central exchange, and, if desired, a condenser 2 can be arranged in the circuit of said generator or machine 1 so as to flatten out the low frequency ringing current and cause its sine wave to become

opaque, said condenser also causing the low frequency current to die down slowly, thus reducing the noise in the subscribers' receivers. The condenser 2 not only smoothes out the current delivered by the machine 1 but it can also be used as a shunt or by-pass for carrying the inductive disturbances on the connected lines around said machine and to the ground, and thus keep the lines at equi-potential.

The central exchange is provided with suitable signals such, for example, as line-drops 3 and 4 for the subscribers A and B, respectively, and also a clearing-out drop 5 for notifying the operator that the subscribers have completed their conversation and hung up their receivers. While I prefer to equip only one limb of the circuit with supervisory signals, it will, of course, be obvious that supervisory signals could be worked over both sides of the circuit.

I have herein stated that an alternating current ringing machine or signaling machine is used at the central exchange but it will, of course, be obvious that any generator of sufficient capacity to deliver the proper amount of alternating current could be used. Furthermore, while it is preferable to use an alternating current machine, a pulsating current machine could be used with equally good results. The central exchange is provided with the usual plugs 6 and 7 that cooperate with contacts 6^a and 7^b, and also keys 8 and 9 for the listening circuit and the ringing circuit.

A repeating coil having four windings, C, D, E and F is arranged in the cord circuit of the central exchange so as to separate the calling side of the cord circuit from the answering side and the clearing-out drop 5 at the central exchange is connected to the middle contacts of the coils C and D of the repeating coil, the other side of the clearing-out drop being connected to the machine 1 which generates the electric current. The machine 1 is preferably grounded at 10, and each subscriber's telephone is equipped with cooperating contacts 11 and 12 that control the subscribers' line-drops at the central exchange. The contact 12 is preferably grounded at 13, but, if desired, said contact could be positively connected to the generating machine 1 by a metallic conductor of any suitable type. In the system herein shown, the hook 14 of each subscriber's telephone, which supports the receiver 15, is provided at one end with an extension 16 that automatically closes the contacts 11 and 12 when the receiver is removed, thus throwing a temporary ground on the sleeve side of the line by completing the circuit through the ground, through the condenser and generating machine at the central office, and through the winding of the coil of the line-drop at

the central exchange. While the two subscribers are conversing through the cord circuit at the central exchange no current from the ringing machine or pole-changer 1 at the central exchange will be passing out over the subscribers' lines. By having the clearing-out drop connected to the middle contacts of the coils C and D of the repeating coil and also arranged in series with the generator 1 and the condenser to the ground the lines do not become unbalanced and consequently very little flow of ringing current or noise is perceptible in the receivers of the subscribers' telephones when they are talking.

One advantage of a system of the character above described is that the clearing-out drop at the central exchange does not operate automatically when the called subscriber removes the receiver of his telephone from its hook in answering a call, this being due to the fact that the calling side of the cord circuit is separated from the answering side by the two windings E and F of the repeating coil. Consequently, in a system of the character above described the operator at the central exchange does not get a false signal whenever a subscriber removes his receiver to answer a call. Of course, when the called subscriber removes the receiver of his telephone from its supporting hook a ground is thrown on the sleeve side of the line for an instant but this does not affect the clearing-out drop owing to the fact that the calling side of the cord circuit is separated from the answering side by the repeating coil. When the called subscriber hangs up his receiver a temporary ground is thrown on the sleeve side of the line but this also has no effect on the clearing-out drop because the coils E and F of the repeating coil separate the calling side of the cord circuit from the answering side. Therefore, in my improved system supervision is had only on the answering side of the cord circuit because the clearing-out drop operates automatically only when the subscriber who originated the call hangs up the receiver of his telephone.

Another advantage of my system is that the inductive disturbance from one line to another is reduced to a minimum by reason of the fact that the current passes from one-half of the cord circuit to the other half only inductively through the four windings of the repeating coil which acts as a transformer. The advantage of such a construction is very apparent whenever a long toll line is connected to a short line for a repeating coil arranged in the manner above described keeps the circuit in balance and prevents the noise on one line from passing to the other line. The repeating coil is designed for talking only, the fluctuating voice currents flowing through either coils

C, D, or E, F. The current flowing through C, D, produces, by induction, a difference of potential between points E and F and as a result an alternating current is set up in the calling side of the cord circuit. The repeating coil which I prefer to use is built in such a manner that the amount of current that is induced or transformed through the different windings in the coil is not strong enough to operate the clearing-out drop.

I have herein shown my invention embodied in a system in which the receiver hooks of the subscribers' telephones are provided with means for automatically closing the contacts that control the line-drops when the receiver is removed but I do not wish it to be understood that my broad idea is limited to such a construction for if desired each subscriber's telephone could be equipped with a manually-operated device separate and distinct from the receiver hook for controlling said contacts. My broad idea consists in arranging a repeating coil in the cord circuit at the central exchange so as to cause the current to pass from one side of the cord circuit to the other side inductively through the windings of the repeating coil, the particular type of apparatus at the subscribers' stations and at the central exchange being immaterial so far as my broad idea is concerned.

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

1. A telephone system comprising a grounded generating machine located at the central office or exchange, line-drops and a clearing-out drop connected to one side of said machine, subscribers' telephones provided with local batteries or other suitable means for operating the transmitter circuits, means for establishing connection between the subscribers' telephones and the central exchange, and a repeating coil bridged across the cord circuit at the central exchange and connected to said clearing-out drop.

2. A telephone system comprising a generating machine located at the central office or exchange, line-drops and a clearing-out drop connected to said machine, subscribers' telephones provided with local batteries or other suitable means for operating the transmitter circuits, and means for completing a circuit through said generating machine and one of said line-drops when a subscriber answers a call and for completing a circuit through the clearing-out drop and said generating machine when said subscriber completes his conversation.

3. A telephone system comprising a central exchange which is equipped with line-drops and a clearing-out drop, an electricity-generating machine connected to said line-drops and to one side of said clearing-out drop, a repeating coil bridged across the

cord circuit at the central exchange and connected to the other side of said clearing-out drop, and subscribers' telephones adapted to be connected with the central exchange and provided with individual batteries for operating the transmitter circuits.

4. A telephone system having an electricity-generating machine connected to the cord circuit at the central exchange, a repeating coil bridged across said cord circuit, a clearing-out drop connected to the middle contacts of two of the coils of said repeating coil and also connected to said generating machine, and subscribers' telephones provided with local batteries.

5. In a telephone system, a central exchange provided with means for establishing connection between the telephones of different subscribers, induction coils bridged across the cord circuit at the central exchange, a generating machine located at the central exchange, a condenser arranged in the circuit of said machine, and a signal arranged between said machine and induction coils.

6. In a telephone system, a central exchange provided with a signal for notifying the operator that a conversation has been completed, means at the central exchange for generating an electric current to operate said signal, subscribers' telephones provided with local batteries, and means whereby said signal remains inoperative when the called subscriber removes or replaces the receiver of his telephone on its supporting hook.

7. In a telephone system, subscribers' telephones provided with local batteries or other suitable means for operating the transmitter circuits, a central exchange provided with a signal for notifying the operator that a conversation has been completed, means at the central exchange for generating electric current to operate said signal, and means for causing said signal to operate only when the subscriber who originated the call places the receiver of his telephone on its supporting hook.

8. In a telephone system, a generator connected to the cord circuit at the central exchange, a condenser arranged in the circuit of said generator, a repeating coil bridged across the cord circuit, a clearing-out drop tapped into said repeating coil and connected in series with said generator, line-drops at the central exchange, and contacts located at the subscribers' telephones and connected to said line-drops and generator.

9. A telephone system comprising a grounded alternating current ringing machine located at the central office or exchange, line-drops and a clearing-out drop connected to one side of said ringing machine, wires leading from said line-drops to contacts which are arranged adjacent the telephones of the subscribers of the system,

coöperating grounded contacts that are adapted to engage the contacts previously referred to and thus complete circuits through said line-drops and clearing-out drop, a repeating coil bridged across the cord circuit at the central exchange, and a conductor connected to one side of said clearing-out drop and to the middle contacts of one pair of coils of the repeating coil.

10 10. A telephone system comprising a generating machine located at the central office or exchange, line-drops and a clearing-out drop connected to one side of said machine, 15 wires leading from said line-drops to contacts which are arranged adjacent the telephones of the subscribers of the system, coöperating contacts that are adapted to engage the contacts previously referred to and thus complete circuits through said line-drops and clearing-out drop, a repeating coil bridged across the cord circuit at the central exchange, a conductor connected to one side of said clearing-out drop and to the 20 middle contacts of one pair of coils of said repeating coil, and means for completing a circuit through said generating machine and one of said line-drops when the receiver of 25 a subscriber's telephone is removed from its

hook and for completing a circuit through the clearing-out drop and said generating machine when the receiver is replaced on said hook.

11. A telephone system, consisting of a central exchange that comprises an operator's telephone, line-drops, a clearing-out drop, and an alternating current grounded ringing machine, connections between said ringing machine and one side of the clearing-out drop and each of the line-drops, a repeating coil bridged across the cord circuit of the central exchange and connected to the other side of said clearing-out drop, subscribers' telephones adapted to be connected with the cord circuit of the central exchange, a grounded contact located adjacent each of the subscribers' telephones, and a coöperating contact connected to a conductor that leads from the subscriber's line-drop at the central exchange.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this twenty-ninth day of October 1909.

FRANK C. UNGER.

Witnesses:

WELLS L. CHURCH,
GEORGE BAKEWELL.