June 14, 1932. H. H. SCHIMMING 1,862,608

ARRANGEMENT FOR PRODUCING MODULATED CURRENTS

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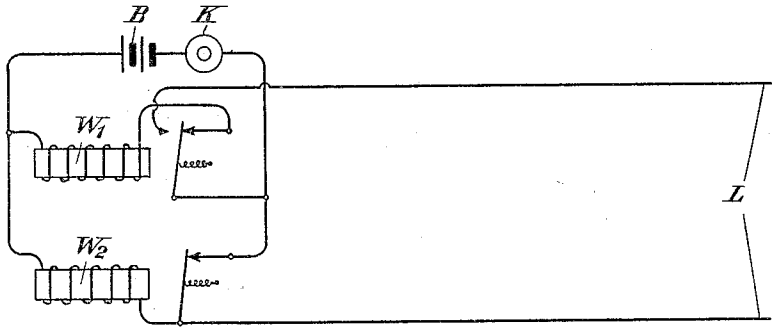


Fig. 1

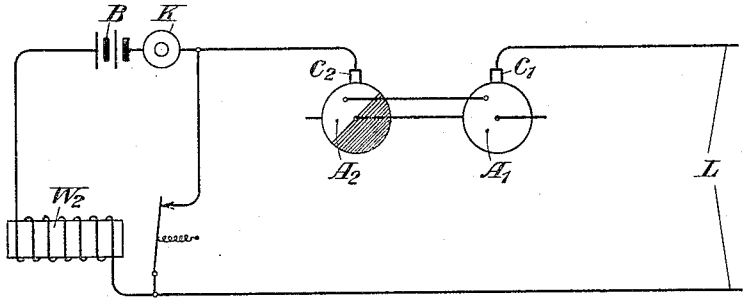


Fig. 2

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UNITED STATES PATENT OFFICE

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ARRANGEMENT FOR PRODUCING MODULATED CURRENTS

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This invention relates generally to signaling systems. More particularly, this invention relates to arrangements for producing modulated currents. Still more particularly, this invention relates to apparatus for producing modulated currents suitable for ringing purposes in telephone systems.

On long haul telephone circuits employing intermediate amplifiers, it is of advantage to use terminal signaling equipment for ringing purposes which may be operated by alternating current, the frequency of which is in the voice range. Since the signaling current is in the voice frequency range, the need for signal relaying equipment at the various amplifying points becomes obviated and the signaling current may be passed and amplified by each amplifier in the same manner as in ordinary speech currents.

To insure against false operation of the signaling equipment by voice currents or other currents not intended for ringing purposes, it is the practice to arrange the signaling equipment to operate only on currents which meet two frequency requirements. Thus, in this country this requirement is usually met by employing one thousand cycle current interrupted twenty times per second.

There has recently arisen a demand for means whereby a lineman may produce and transmit the double frequency signaling current for ringing purposes. In order for equipment to be satisfactory for such purposes, it is necessary that such equipment be light in weight and small in size so that it may, for example, form part of the telephone lineman's familiar test set. It is also important that such equipment be quite inexpensive.

This invention proposes to provide suitable arrangements for meeting the requirements set forth hereinabove. Thus, it may be stated in general that the invention involves two devices, one capable of providing current of a particular frequency and the other capable of interrupting the output of the first device at a second particular frequency.

This invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing in which Fig. 1 represents one embodiment of the invention including two buzzers so related as to be capable of producing currents of two different frequencies and Fig. 2 of which includes a buzzer producing current of one frequency and a commutator arrangement for interrupting this current at another frequency.

In Fig. 1 of the drawing, the reference character L designates a line over which signaling or ringing currents may be transmitted. The reference characters W_1 and W_2 represent two buzzers, the armatures of which are designed to vibrate, for example, twenty and a thousand times a second. A battery designated B which may be composed of a plurality of dry cells supplies a current which is interrupted or modulated by these buzzers so as to produce ringing currents suitable for transmission over the line L.

Upon the operation of key K, current will flow from the battery B through the winding of relay W_1, the circuit being completed through the armature and back contact of this relay and key K. The winding of relay W_1 will then become energized and its armature will be attracted so as to close its front contact. A spring is attached to the armature of relay W_1 and this spring will thereafter retract the armature of the relay and cause it again to close its back contact. Current will flow from battery B over the winding of the relay W_1, again closing its front contact, and so on. It is to be noted that the armature of relay W_1 is so designed and so arranged with respect to its associated elements that this relay will act as a buzzer and its armature will vibrate back and forth between its contacts a predetermined number of times each second so long as key K remains operated. Thus, the armature of this relay may close its contact twenty times per second.

Current will also flow from battery B through the winding of relay W_2, the circuit being completed through the armature and contact of this relay and key K. The wind-

ing of relay W_2 will become energized and its armature will be attracted so as to open its associated contact. The spring tied to the armature of this relay will retract this armature and cause it again to close its associated contact. Current will flow from battery B through the winding of relay W_2, immediately thereafter causing its armature to open its associated contact, and so on. It is to be noted that the armature of the relay W_2 is so designed and so arranged with respect to its associated elements that this relay will also act as a buzzer and its armature will move back and forth, successively closing the associated contact a predetermined number of times each second. Thus, the armature of this relay may, for example, close its contact a thousand times a second.

When the relay W_1 is unoperated, no current can flow from battery B over the line L by virtue of the fact that the front contact of this relay is open. Inasmuch as this relay remains unoperated for approximately 1/40th of a second, no current will flow from battery B over the line L during this interval.

When the relay W_1 becomes operated, battery B and the winding of relay W_2 will be connected to the line L. While relay W_1 remains operated, the relay W_2 will operate and the armature of relay W_2 will close and break its associated contact a thousand times a second. Each time the contact of the relay W_2 becomes closed, the line L will become short-circuited by a path provided by the armature of relay W_2 and its contact and by the armature of the relay W_1 and its forward contact. Under these conditions no potential will be impressed on the line L. However, each time the contact of the relay W_2 is broken, the line L will receive the inductive discharge from the winding of relay W_2 plus the voltage of battery B. Thus, the line L will alternately receive a potential and be short-circuited at the rate of a thousand times a second during each 1/40th of a second. Consequently, current will be produced and transmitted over the line L and this current will have a frequency of a thousand cycles and it will be interrupted twenty times each second.

The arrangement shown in Fig. 1 of the drawing was successfully incorporated in a familiar telephone lineman's test set and it satisfactorily produced the current required to operate the ordinary one thousand-cycle ringers so widely used in the telephone plant. In the arrangement actually tried out, the twenty-cycle magneto of the test set was removed and the two buzzers described hereinabove installed in its place. In order to prevent the buzzers from getting out of adjustment due to rough handling, they were mounted on sponge rubber. The talking and ringing operations were controlled by a special key which, when operated in one direction, cut off the talking circuit and operated the buzzers so as to produce the current required for ringing purposes and, when operated in the other direction, cut out the buzzers so that the lineman could talk to a party at the other end of the line.

Fig. 2 of the drawing shows another embodiment of the invention in which the twenty-cycle buzzer formed by relay W_1 is replaced by a commutator arrangement which may be mounted on the test set magneto. Here the relay W_2 is connected to the battery B in the manner shown in the Fig. 1. A commutating arrangement is placed in series with the line L and some point common to the battery B and the contact closed by the armature of the relay W_2.

The commutating arrangement of Fig. 2 consists of two rotors designated A_1 and A_2 which may be mounted on a common shaft as shown or otherwise coupled to each other. These rotors are revolved at a common speed. The rotor A_1 is formed of conductive material and is continually in contact with a brush C_1. The rotor A_2 is divided into two sections, one of which is conductive and the other insulating, these sections alternately contacting with a brush C_2. The conductive section of rotor A_2 is conductively connected to the rotor A_1. This arrangement in conjunction with relay W_2 will obviously produce a thousand-cycle current interrupted twenty times per second.

This commutating arrangement may be mounted on the armature shaft of the magneto in the familiar lineman's test set. If the one thousand-cycle buzzer W_2 is connected in the manner shown in the drawing and described hereinabove, the twenty-cycle buzzer W_1 shown in Fig. 1 may be eliminated. By the turning of the magneto of the test set at a predetermined speed, the commutator will interrupt the thousand-cycle current twenty times per second.

While this invention has been shown and described in certain particular embodiments merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a battery, first and second relays, and a line, one terminal of each of the windings of said relays being connected to one terminal of said battery, the back contact of the armature of the first relay being connected to the other terminal of the winding of the first relay, the armature of the first relay and the back contact of the second relay being connected to the other terminal of said battery, one side of said line being connected to the front contact of the armature of the first relay, the other terminal of

the winding of the second relay and its armature being connected to the other side of said line.

2. The combination of a battery, a relay the winding of which is connected in a series circuit with said battery through the armature and back contact of the relay, and a commutating device connected in another circuit in series with the armature and the back contact of said relay.

3. The combination of a source of direct current, a buzzer the winding of which is connected in series with said source as well as with its own armature and back contact, and a commutating device connected in series with the armature and back contact of said buzzer, said commutating device including two coupled rotors one of which is composed of conducting material and the other of which is composed of two sections, one of insulating material and the other of conducting material which is electrically connected to the first rotor.

4. The combination of a battery, a relay, a telephone line, and a commutating device, the winding of said relay and its armature and back contact being directly connected across the said battery, the line being directly connected across the armature and back contact of said relay through said commutating device.

5. The combination of a battery, a relay, and a telephone line, the battery being connected in series with said telephone line through the winding of said relay, the armature of said relay shunting said telephone line upon the release of said relay.

6. The combination of a battery, a relay capable of being operated a predetermined number of times each second, a line which may be shunted by the armature of said relay each time it becomes released, and means for integrating the voltage of said battery and of the winding of said relay and impressing the integrated voltage on said line each time said relay becomes operated.

7. Apparatus for producing alternating currents of two distinct frequencies for telephone ringing purposes, comprising a source of direct current, two relays, the armatures of which are capable of vibrating at different predetermined rates, the winding of each relay being connected to said source through its own armature and back contact, and a telephone line connected between the front contact of one of said relays and the armature of the other of said relays.

In testimony whereof, I have signed my name to this specification this 17th day of November, 1930.

HAROLD H. SCHIMMING.