

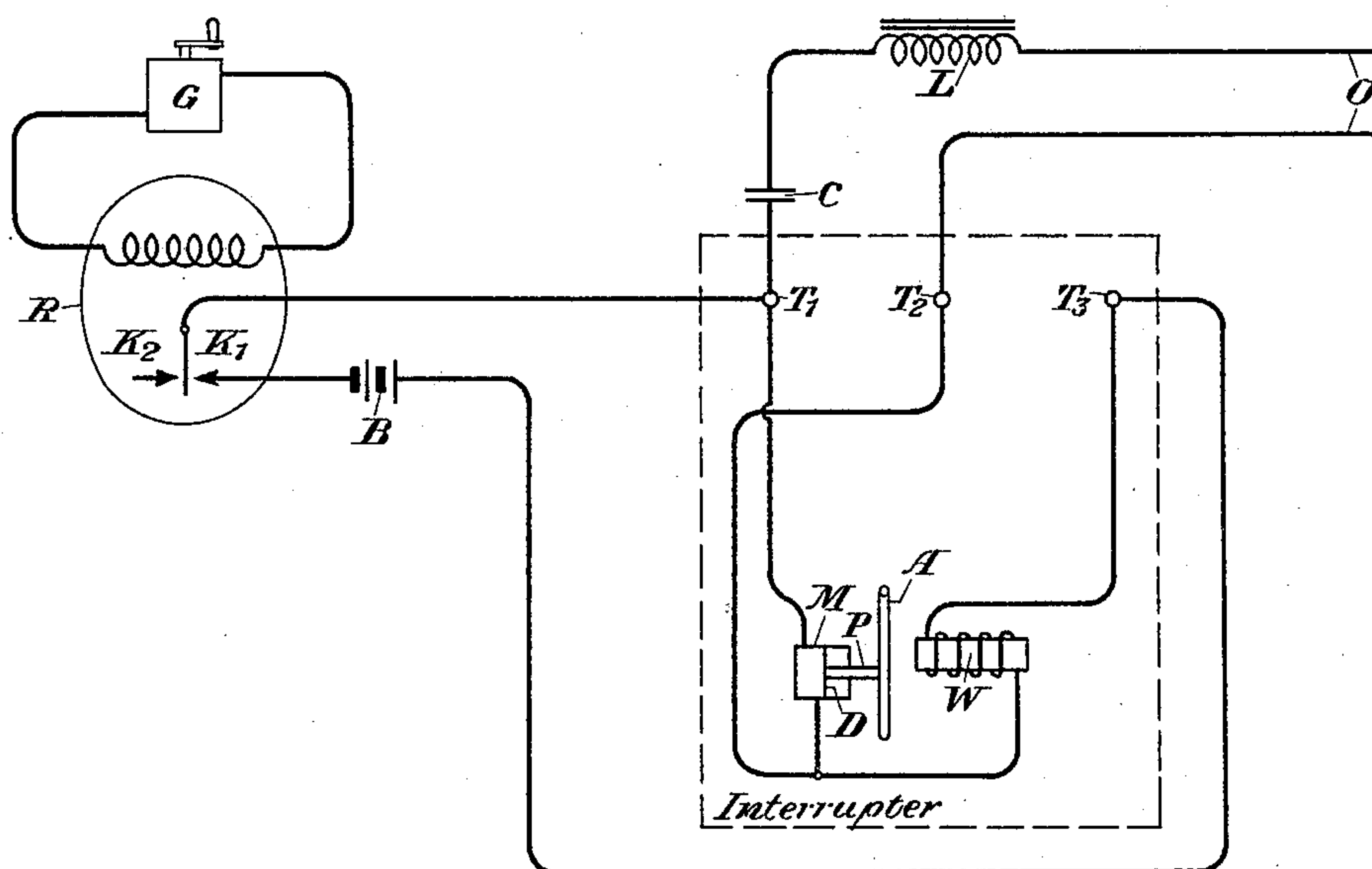
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ARRANGEMENT FOR PRODUCING MODULATED CURRENTS

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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 often of advantage to use terminal signaling equipment for ringing purposes which may be operated by alternating current having a frequency lying within the ordinary voice range. Since the signaling current is within the voice 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 are 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. In this country this requirement is usually met by employing 1,000 cycle current interrupted about 20 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 and testing purposes. In order for equipment to be satisfactory for these purposes, it is necessary that the equipment be light in weight and small in size so that it may, for example, form part of a 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 fol-

lowing when read in connection with the accompanying drawing which represents one embodiment of the invention showing its essential elements merely for the purpose of illustration.

Referring to the drawing, the reference character G represents a hand generator of alternating current which may preferably be a sub-audible frequency of predetermined value, as for example, 20 cycles, but the generator G may be replaced by any form of apparatus well known in the art which is capable of producing an audible frequency or some frequency above the audible limits, if so desired. The generator G shown in the drawing is connected to the winding of a polar relay R, the armature of which is free to vibrate between two contacts  $K_1$  and  $K_2$ . The armature of the relay R will close contact  $K_1$  once for each cycle of the alternating current impressed upon its winding.

The apparatus included within the confines of the box shown in dotted lines, represents an interrupter. It comprises a carbon button contact arrangement M, a coil of wire W wound on a core of iron, a reed A which may be made of iron or other magnetic material and which may be adjusted or tuned to vibrate at any desired frequency as, for example, 1,000 cycles per second, a plunger P which need not have magnetic properties, and a diaphragm D. The reed A continually rests against the plunger P and presses against the diaphragm D adjacent to the carbon button arrangement M. A battery designated B supplies the energy required to operate the interrupter. The battery B, the winding W and the carbon button arrangement M are connected in series relationship.

When the armature of the relay R rests against the contact  $K_1$ , the winding W will be energized by current which flows from the battery B through the carbon button arrangement M. An attractive force will be exerted by the winding W on the reed A and it will be drawn away from the carbon button arrangement M. Since the reed A is separated from the diaphragm D by a plunger P, the attraction of the reed A will reduce



the pressure on the diaphragm D and there will then be a corresponding increase in the resistance of the carbon button arrangement M, and therefore a decrease in the current flowing from battery B through the winding W. This decrease in the current through the winding W will reduce the attractive force of the winding W upon the reed A and, consequently, the pressure of the reed A against the diaphragm D will be increased, thereby completing one cycle of changes in the current flowing through the winding W, as well as in the pressure exerted on the diaphragm D. The continued repetition of this cycle will result in a steady vibration of the reed A at a constant frequency, and an alternating current electromotive force having the same frequency as the reed A will be set up across the terminals of the carbon button contact arrangement M, which are designated T<sub>1</sub> and T<sub>2</sub>. If the reed A vibrates at 1,000 cycles per second, the voltage variations of the carbon button contact arrangement M will occur at the same frequency.

A line designated O is connected to the terminals T<sub>1</sub> and T<sub>2</sub> of the carbon button contact arrangement M through a retard coil L and a condenser C. The condenser C primarily prevents direct current originating at the battery B from being applied to the circuit O. The coil L presents a desired amount of inductance or impedance for the circuit O, yet it will be understood that under certain conditions, especially where additional inductance or impedance is not required, the coil L may be dispensed with.

The vibrator produces alternating current variations as long as the contact K<sub>1</sub> is closed by the armature of the polar relay R. Inasmuch as the armature of the relay R is periodically closed in accordance with the frequency of the alternating current impressed upon its winding by the generator G, the alternating variations of the vibrator will be interrupted at the frequency of the armature of the relay R. If the armature of the relay R is vibrated at, for example, about 20 cycles per second, and assuming the frequency of the vibrator to be 1,000 cycles per second, there will be transmitted to the circuit O current of 1,000 cycles per second interrupted 20 times per second which will operate the ringing or other equipment at the other end of the line. The generator G is obviously a hand operated device having a crank, operating gears which rotate an armature at any desired speed. This crank may, for example, be operated so as to rotate the armature at 20 revolutions per second.

While this invention has been shown and described in certain particular arrangements 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 depart-

ing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a portable test set, the combination of a polar relay, a source of current of one frequency connected to the winding of the polar relay, an interrupter, a source of direct current connected to said interrupter for producing alternating current variations at a second frequency, and means interconnecting the armature of the polar relay and said interrupter for producing current of the second frequency interrupted in accordance with the first frequency.

2. In a portable test set, the combination of a polar relay, an interrupter which includes a winding, a reed, a carbon button of variable resistance, a diaphragm controlling the resistance of the carbon button, and a plunger separating the reed from the diaphragm, and a source of direct current connected in series with the armature and one of the contacts of said polar relay as well as with the winding and the carbon button of said interrupter.

3. In a portable test set, the combination of a polar relay, a hand generator connected to the winding of the polar relay and transmitting a low frequency alternating current, an interrupter which includes a winding, a magnetic reed, a carbon button of variable resistance, a diaphragm controlling the resistance of the carbon button, and a plunger interposed between the reed and the diaphragm, a source of direct current connected in series with the armature of the polar relay and one of its contacts as well as with the winding and the carbon button of the interrupter, and a line connected across the carbon button of the interrupter.

In testimony whereof we have signed our names to this specification this 12th day of May, 1931.

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