Sept. 20, 1932. W. A. STEVENS 1,878,724

GENERATING AND MODULATING APPARATUS

Filed June 25, 1930

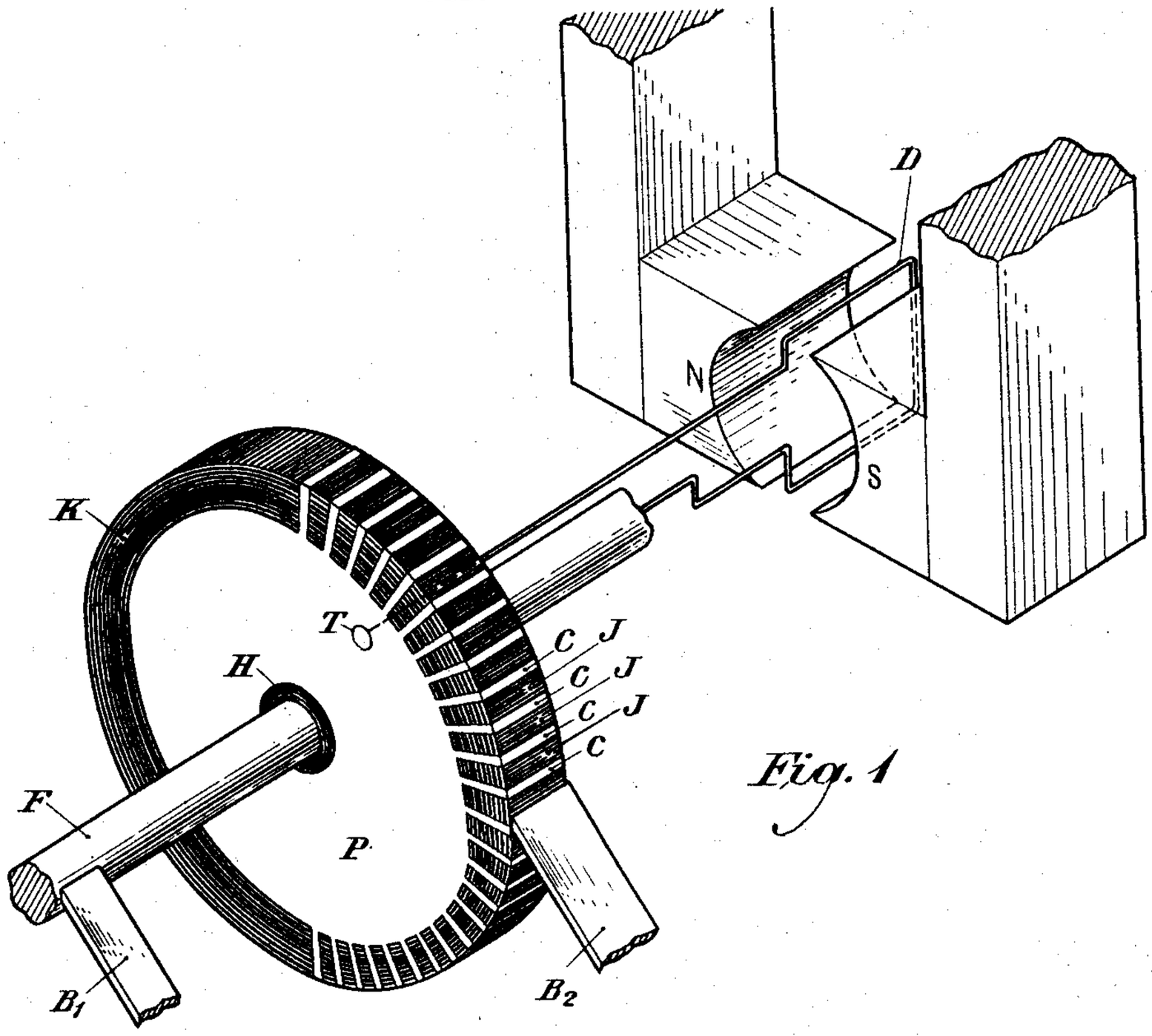

Fig. 1

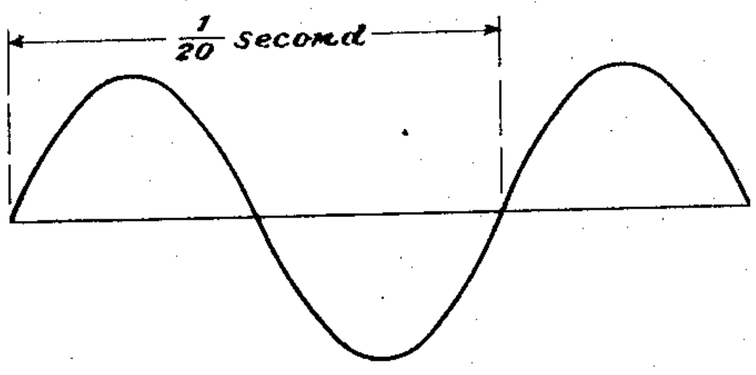

Fig. 2

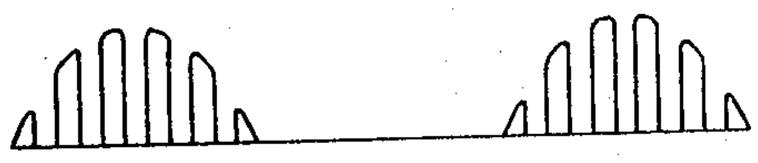

Fig. 3

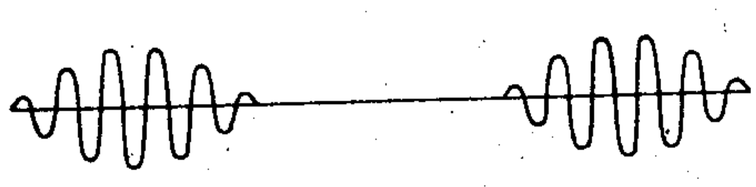

Fig. 4

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Patented Sept. 20, 1932

1,878,724

UNITED STATES PATENT OFFICE

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GENERATING AND MODULATING APPARATUS

Application filed June 25, 1930. Serial No. 463,703.

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 employing a plurality of commutating elements for producing modulated currents suitable for ringing purposes in telephone systems.

On long haul telephone circuits it is of advantage, in the case of circuits employing intermediate amplifiers, to use terminal signaling equipment for ringing purposes, this equipment being 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 is obviated, and this signaling current is passed and amplified by each amplifier in the same manner as ordinary speech currents.

To ensure 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 the United States, this requirement is met by employing 1000-cycle current interrupted 20 times per second. In European countries, as well as in certain other countries, 500-cycle current interrupted 20 times per second is employed.

This invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing, in which Figure 1 represents an arrangement shown in perspective for carrying out the principles of this invention, and Figs. 2, 3 and 4 represent curves characteristic of the invention.

Referring to Fig. 1 of the drawing, an alternating current generator is shown, consisting of a permanent magnet having two pole pieces N and S exhibiting opposite magnetic polarity. The field established by this permanent magnet is cut by a conducting element designated D, which may be of well known construction. The voltage between the terminals of this conducting element D as it is revolved uniformly in the magnetic field, continually changes in magnitude and reverses in polarity after every half revolution. The nature of the wave produced by this generator is approximately sinusoidal in shape, and is shown in Fig. 2.

A commutator is associated with the alternating current generator just described. This commutator consists of a metallic plate P which may be revolved in the same direction as the conducting element of the generator. The metallic plate P is located concentrically about a shaft F and is separated from the shaft F by an annular bushing of insulating material designated H.

The peripheral portion of the commutator is divided into two sections. One of these sections is composed of a continuous layer of insulation designated K, and this section may extend over about one-half of the circumference of the commutator, as shown. The other half of the circumference may be composed of a plurality of segments of conducting material, each designated C, all of which are separated from each other by a plurality of segments of insulating material formed of rubber, bakelite, etc., each of which is designated J. The various conductive segments C may actually be portions of the plate P which may have been cut away so as to receive the various insulating elements J. Or, the various conductive segments C may be individual members of conducting material soldered to the plate P.

Two brushes B_1 and B_2 are employed in this invention for the purpose of receiving the modulated currents generated. Brush B_1 is mounted adjacent to and against the shaft F, while brush B_2 is mounted so as to make progressive contact with the various conductive segments C as the plate P is revolved. It will be apparent that brushes B_1 and B_2 may be wired to a circuit over which may be transmitted the modulated currents generated by the system.

The conducting element D of the generator may be mounted on the shaft F in any well known manner, or it may be mechanically coupled thereto. The shaft F may be directly connected to a crank or indirectly so con-

nected through a pair of gears (not shown). In any event, the apparatus shown may be arranged so that a complete revolution of the shaft F will cause the conducting element D of the generator, as well as the plate P of the coupled commutator, to revolve through 360°, and the conducting element D will provide between its terminals a varied voltage having the wave shape shown in Fig. 2.

It will be noted that one terminal of the conducting element D will be directly connected to the metallic shaft F, and that its other terminal is conductively connected to the plate P at T. Thus, the effects produced by the two coupled elements P and D of this invention will be effectively in series relationship and will produce the modulated currents of the type employed in telephone ringing systems, the features of which will be better understood from the following description.

The embodiment shown in Fig. 1 discloses an arrangement of a two-pole generator the armature of which is coupled to a specially designed commutator so set up that both may rotate in synchronism. The fundamental frequency of the generated current is determined by the speed of rotation of the shaft F common to both elements. If, for example, the shaft F makes 20 revolutions per second, 20-cycle current will be delivered by the conducting element D of the two-pole generator to the shaft F and terminal T, and this current will have the wave shape shown in Fig. 2. Inasmuch as both elements are wired effectively in series relationship, it will be noted that one-half of the current wave will be eliminated when the continuous insulating segment K reaches brush B_2. As long as segment K is in contact with brush B_2, no current will be transmitted to the circuit connected with brushes B_1 and B_2. As the various conductive segments C and the various insulating elements J pass brush B_2, the other half of the wave produced by the rotation of the commutating element D will be periodically interrupted, and the interrupted wave will be transmitted over the circuit connected to brushes B_1 and B_2. The interrupted wave will have the shape shown in Fig. 3, and the frequency of interruption will depend upon the number of insulating elements interposed about the periphery of the specially designed commutator. Thus, if the shaft F makes 20 complete revolutions per second, as stated hereinabove for the purpose of illustration, one-half of a complete cycle will be generated during 1/40th of a second. If this current is interrupted 25 times, due to the presence of 25 equal insulating elements J, the frequency of interruption will be the product of 40 and 25 or 1,000 times per second. If the interrupted current having the wave shape shown in Fig. 3 is passed through a transformer of, for example, the two-winding type, there will be produced a modulated current of the type shown in Fig. 4, and this current will be the equivalent of a current of 1,000 cycles interrupted 20 times per second. A modulated current of this type is required to operate voice frequency signaling equipment now employed in the telephone plants throughout the United States.

While this invention has been shown in a certain particular arrangement merely for the purpose of illustration, it will be understood that the 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. Apparatus for producing modulated signaling currents comprising a two-pole generator of alternating current, and rotatable means coupled to said generator for suppressing one-half of each cycle of said alternating current and for interrupting the remaining half of each cycle a predetermined number of times.

2. The combination of an alternating current generator and a rotatable element coupled to said generator, the periphery of said rotatable element consisting of a continuous insulating element extending over one-half thereof, and a plurality of conducting segments extending over the remaining half thereof, all of which are insulated from each other at the periphery.

3. The combination of an armature located in a magnetic field for producing alternating current of low frequency, a disc-shaped commutator mounted concentrically on the shaft of said armature, the periphery of said commutator comprising a continuous layer of insulation extending over one-half thereof, and a plurality of equal layers of insulation spaced from each other over the remaining portion thereof at equal intervals.

4. The method of producing a modulated current suitable for ringing purposes in telephone systems which consists in generating an alternating current, suppressing half of the wave of each cycle, and progressively interrupting the remaining half wave of each cycle a predetermined number of times.

In testimony whereof, I have signed my name to this specification this 23rd day of June 1930.

WALTER A. STEVENS.