S. CABOT.

CIRCUIT CONTROLLER.

APPLICATION FILED MAY 6, 1909.

954,716.

Patented Apr. 12, 1910.

2 SHEETS—SHEET 1.

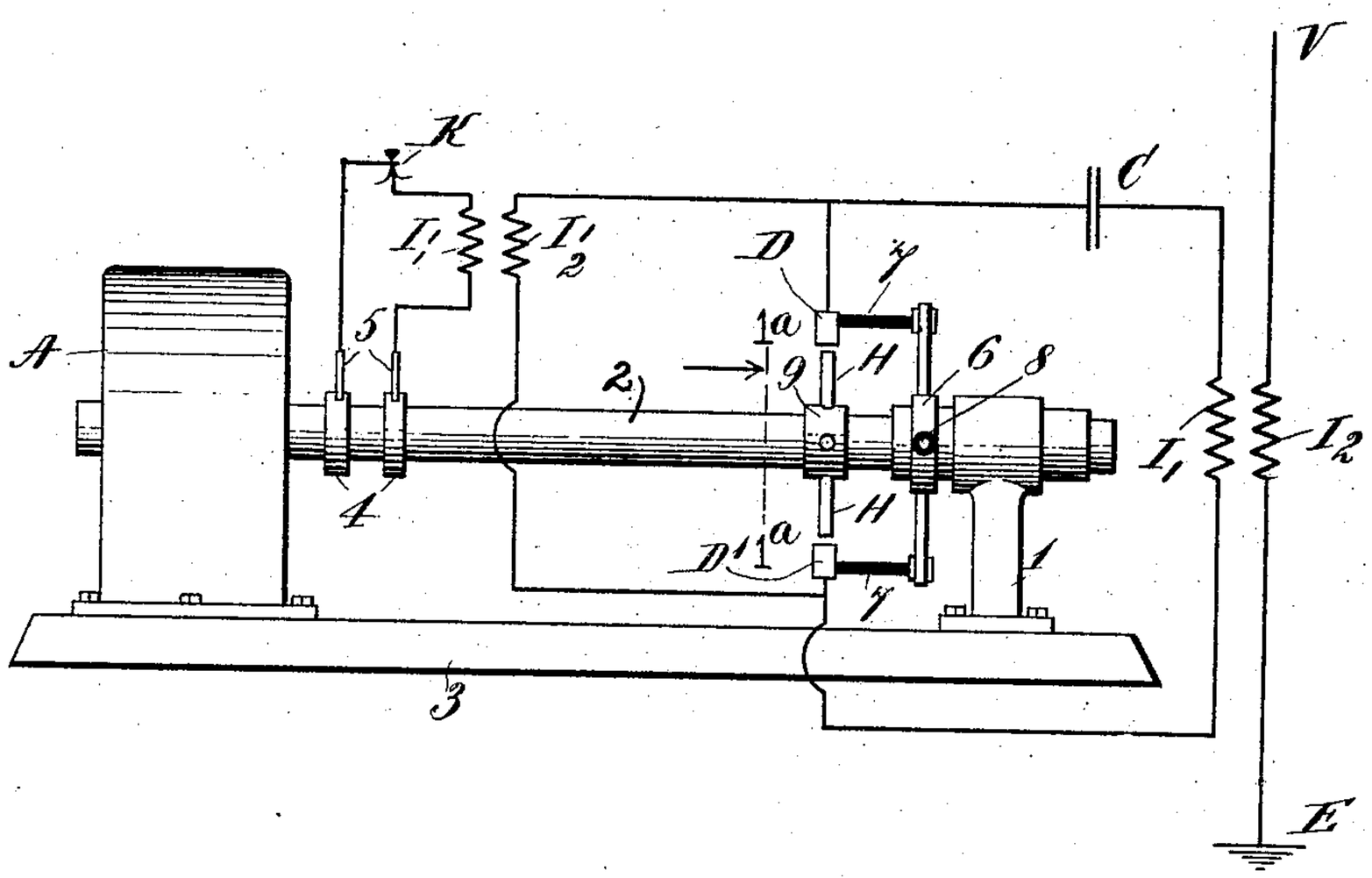

Fig. 1.

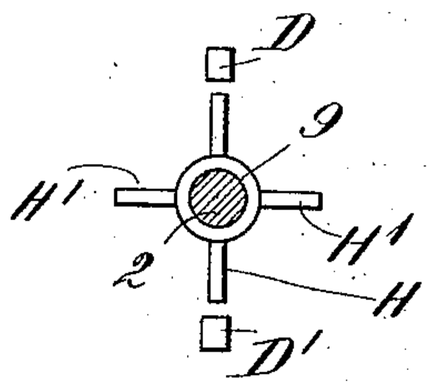

Fig. 1a

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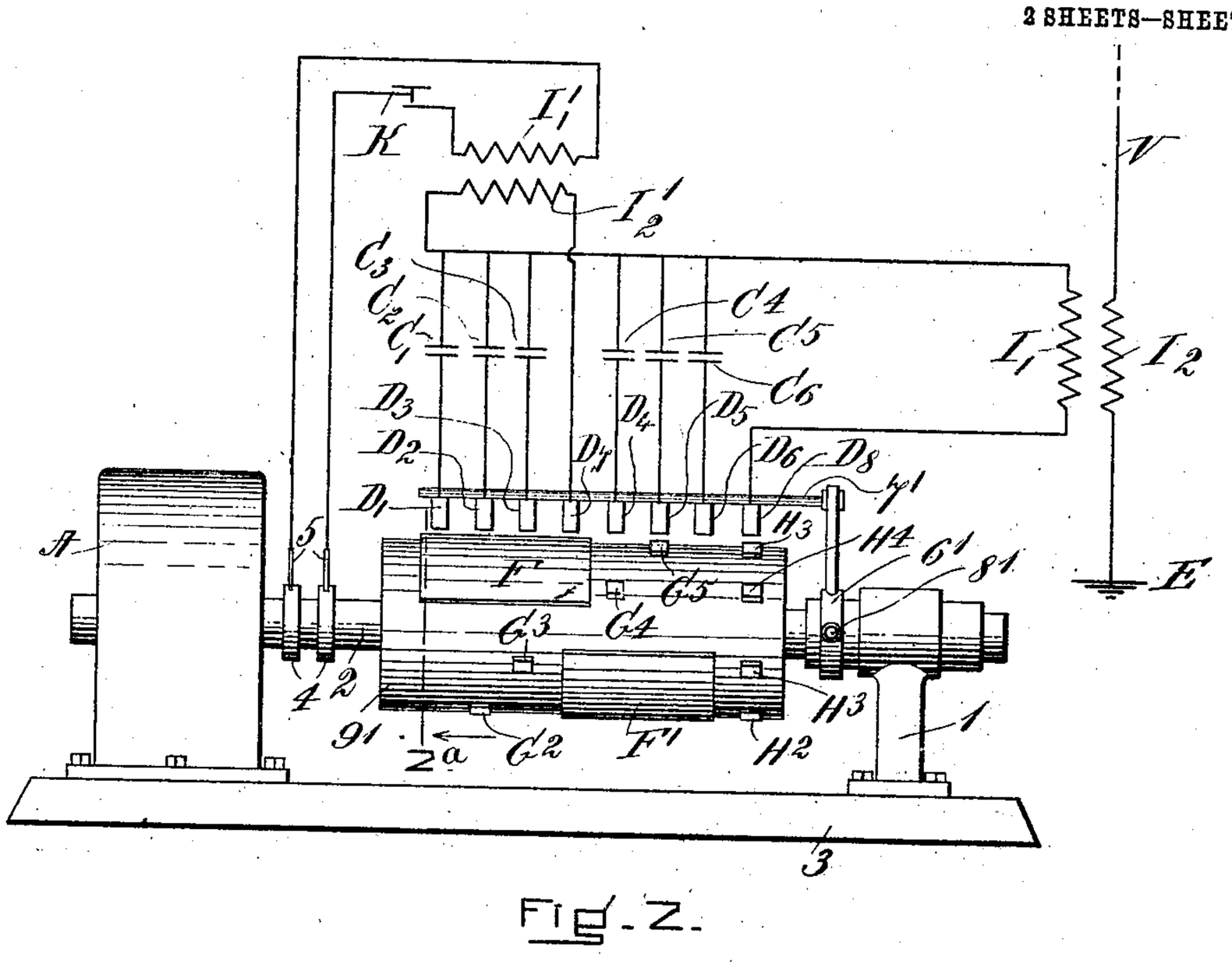

Fig. 2.

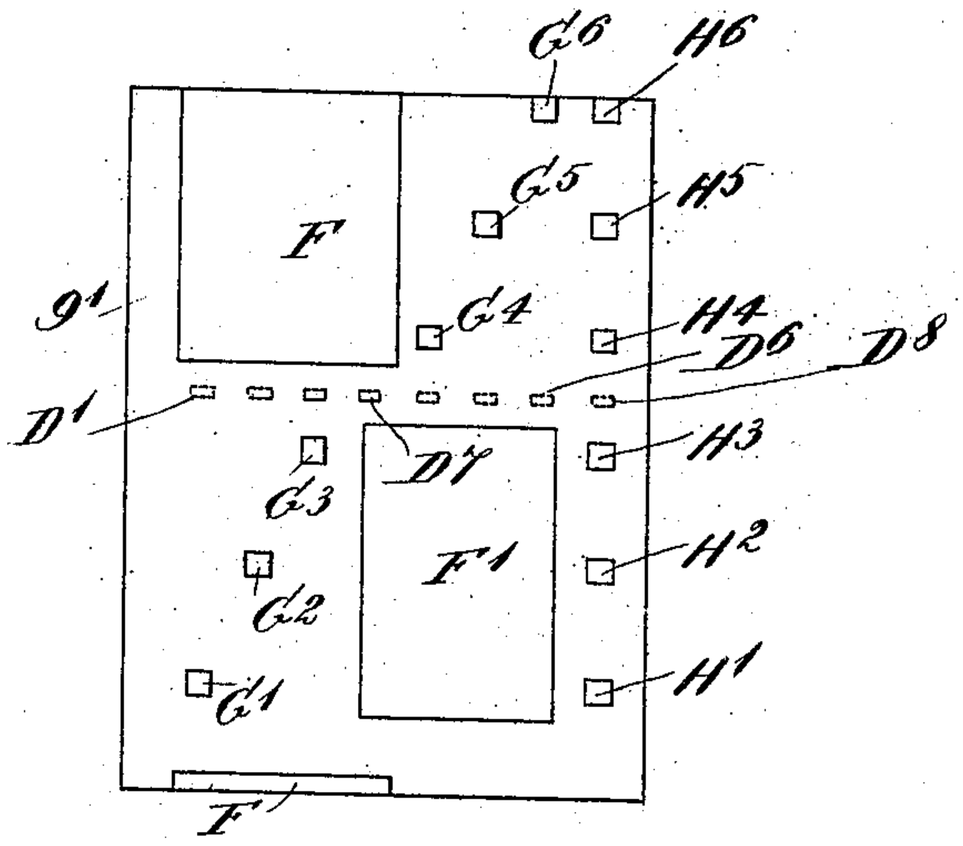

Fig. 3.

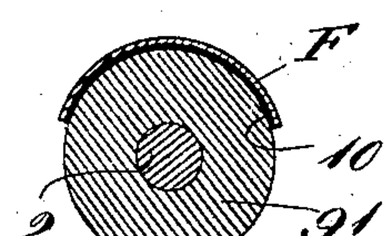

Fig. 2a.

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UNITED STATES PATENT OFFICE.

SEWALL CABOT, OF BROOKLINE, MASSACHUSETTS.

CIRCUIT-CONTROLLER.

954,716. Specification of Letters Patent. Patented Apr. 12, 1910.

Application filed May 6, 1909. Serial No. 494,492.

To all whom it may concern:

Be it known that I, SEWALL CABOT, a citizen of the United States, and a resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Circuit-Controllers, of which the following is a specification.

My invention relates to circuit-controllers and more especially to devices for controlling the operation of sonorous or persistently oscillating circuits which are employed in space telegraphy and other arts for creating high frequency oscillations.

The object of my invention is to increase the pitch and improve the quality of the sound produced in a telephone receiver associated with an oscillation detector in a space telegraph receiving system.

In carrying out my invention I provide the sonorous circuit of a space telegraph transmitting system with a circuit-controller having means for securing a plurality of discharges in said sonorous circuit for each half-cycle of the alternating current in the power circuit of said system, said means being so constructed and arranged that the discharges are separated by practically equal time intervals; and I may employ means whereby all the discharges occur at substantially the same potential.

When a source of alternating current is employed to energize a sonorous circuit having a spark-gap of constant length in a space telegraph transmitting system, the discharges are separated by equal time intervals and occur at the same potential only when said circuit is prevented from making more than one discharge per half-cycle and each discharge takes place when the condenser in the circuit has reached its maximum potential. When more than one discharge per half-cycle occurs, as where an excess of charging potential is impressed upon the condenser in the sonorous circuit, the successive discharges will be unequally spaced although they may occur at substantially the same potential.

When a telephone receiver is employed as the signal-indicating device of a space telegraph receiving system, the sound produced in the receiver by the action of electromagnetic waves resulting from unequally spaced discharges at the transmitting station is a complex noise and not a musical note such as is produced when the said discharges and the resultant trains of waves are separated by equal time intervals. Space telegraph signals can be more accurately received by a telephone receiver associated with an oscillation detector when the discharges at the transmitting station and the resulting trains of waves are regularly spaced and a musical note is produced in said receiver. The sensitiveness of the human ear to vibrations produced by a telephone receiver energized by vibratory currents is a function of the frequency of said currents and the frequency of the vibrations for which the ear is most sensitive has been placed by various authorities as between 640 and 960 per second. Commercial alternating current generators are rarely designed for more than sixty cycles per second and the usual wave train frequency of 120 per second resulting when such a generator is employed for energizing a sonorous circuit will be seen to be far below that for which the ear is most sensitive. While it is possible by means of a specially designed alternating current generator to create at the transmitting station electrical oscillations having a spark frequency as high as desired so that the rate of vibration of the currents in the local receiving circuit including a telephone receiver, shall have the same frequency, it is desirable to employ in the primary power circuit a vibratory current not greatly exceeding 60 cycles per second in frequency. Accordingly by my invention I am enabled to retain for use in space telegraphy the usual commercial alternating current generator producing current of relatively low frequency and at the same time secure as high a wave train frequency as desired, by providing means for insuring a plurality of discharges per half cycle, thereby securing a musical note of the desired high pitch in a telephone receiver at the transmitting station. The quality of the sound heard in said receiver is improved by constructing and arranging said means so that the discharges will be separated by practically equal intervals of time and by providing other means for causing said discharges to occur at substantially the same potential.

My invention may best be understood by having reference to the drawings which ac-

company and form a part of this specification and which represent two arrangements of apparatus and circuits whereby the above specified objects of my invention may be attained.

In the drawings Figure 1 represents, partly in diagram and partly in elevation, a space telegraph transmitting system provided with one embodiment of my improved circuit-controller arranged to secure two discharges in the sonorous circuit for each half-cycle of alternating current in the power circuit. Fig. 1ª is a section taken on the line 1ª—1ª of Fig. 1. Fig. 2 represents partly in diagram and partly in elevation a space telegraph transmitting system provided with another embodiment of said circuit-controller arranged for securing three discharges in the sonorous circuit for each half-cycle of alternating current in the power circuit. Fig. 2ª is a section taken on the line 2ª of Fig. 2. Fig. 3 shows a development of the rotor constituting part of the apparatus represented in Fig. 2.

In the figures V is an elevated transmitting conductor, E is an earth connection, I_1 and I_2 are the primary and secondary windings respectively of an oscillation transformer, C C_1 etc. are condensers, K is a key, I_1' I_2' are the primary and secondary windings respectively of the power circuit transformer, and A in the present instance represents a two-pole alternating current generator. The generator A and the bearing 1 of its shaft 2, or an extension thereof, may be mounted on the base 3. The brushes 5 contact the collector-rings 4 on said shaft and are connected to the key and primary of the power circuit transformer.

9 is a discharger consisting in the present instance of a collar mounted on the shaft 2 and provided with two pairs of diametrically opposite electrodes H H′, the four electrodes being equally spaced.

D D′ are two fixed electrodes connected to a sonorous circuit which includes the condenser C and the primary I_1. Preferably the electrodes D D′ are arranged to be adjusted about the axis of rotation of the rotating electrodes H H′. As shown in the present case the stationary electrodes are carried by the insulating arms 7 connected to the rocker-arm 6 which may be rotated about the bearing 1 through an angle of at least 180 degrees and locked in position by the handle 8 in the usual manner.

A two-pole alternating current generator makes one revolution per cycle and since the electrodes of the discharger rotate synchronously with said generator, two discharges in the sonorous circuit are secured for each half-cycle of the alternating current in the power circuit. By means of the adjustable rocker-arm a position for the stationary electrodes may be secured which will permit the two discharges of the condenser C to occur during each half cycle at substantially the same potential, and any further movement of the rocker-arm will increase the potential of one discharge and reduce the other. In this manner the spark frequency of the oscillations developed in the sonorous circuit is made greater than twice the frequency of the alternating current in the power circuit and thereby the pitch of the sound heard in the telephone receiver at the receiving station is correspondingly raised and at the same time the quality of said sound is improved by the equal separation of the successive discharges which occur at the same potential.

It will be understood of course that I do not limit my invention to use with a two-pole generator and that the same may be applied to generators having a larger number of poles by the simple expedient of correspondingly increasing the number of pairs of rotating electrodes. It will further be understood that the rotating electrodes may be attached to the shaft of a synchronous motor energized by the same current which passes through the primary of the power circuit transformer.

Where it is desired to secure more than two discharges in the sonorous circuit for each half-cycle of current in the power circuit, the apparatus shown in Fig. 2 may be employed. In Fig. 2, 9′ represents a metallic cylinder secured to the shaft 2 of the alternator A (or as above explained, to the shaft of a synchronous motor) carrying two sets of electrodes G_1, H_1, all in electrical contact therewith, and two plates F F′ which are insulated therefrom, as shown at 10 in Fig. 2ª, and extend over nearly 180 degrees of its circumference. The rocker-arm 6′, which may be adjusted about the journal 1 and locked in adjusted position by the handle 8′, carries the insulating arm 7′ to which are secured a series of electrodes D_1—D_8, six of which are connected with the condensers C_1—C_6, respectively, as shown. The electrode D_7 is connected to one terminal of the secondary I_2' and the electrode D_8 is connected to one terminal of the primary I_1.

The arrangement of the rotating electrodes is best shown in Fig. 3. An electrode G is placed opposite an electrode H and the electrodes H, which are equally spaced about the circumference of the cylinder 9′, all lie in a plane normal to the axis of rotation of said cylinder. The electrodes G are staggered and each is arranged to pass under one of the electrodes D which is connected with one of the condensers, the relative position of the series of electrodes D being indicated in dotted lines in the development of the cylinder shown in Fig. 3. The plate F is arranged to pass under three

electrodes D which are connected with the condensers and also under the electrode D_7 and the plate F′ is arranged to pass under the other three electrodes D which are connected to the other three condensers and also under the electrode D_7. The electrodes H are arranged to pass under the electrode D_8. Assuming that the cylinder is rotating in a clockwise direction with respect to an observer stationed at the alternator end and looking toward said cylinder, the electrodes D_1, D_2, D_3, D_7 will simultaneously be over the plate F or in contact therewith, and the condensers C_1, C_2, and C_3 will be connected in parallel with each other and in series with the secondary of the power circuit transformer whereby they will be simultaneously charged. The further rotation of the cylinder will bring the electrode G_1 under the electrode D_1 at the same time that the electrode H_1 is under the electrode D_8 whereby the said condenser will discharge across the gap or gaps between the two pairs of coöperating electrodes through the inductance I_1, said condenser and inductance constituting for the time being a sonorous circuit. In like manner the condensers C_2 C_3 successively discharge through said inductance, and while the condensers of the first set are successively discharged during one-half cycle of the alternating current in the power circuit, the condensers C_4 C_5 C_6 of the second set are being simultaneously charged, and further rotation of the cylinder during the next half cycle of said alternating current will cause the condensers of said second set to successively discharge through the inductance I_1 while the condensers of the first mentioned set are charging.

The rocker-arm 6′ may be adjusted through an angle of at least 180 degrees about the axis of rotation of the cylinder 9′ so that each condenser will be charged with the maximum potential at the instant the plate F or F′ passes away from the electrodes connected with said condensers.

It will be understood that a larger number of discharges in the sonorous circuit for each half-cycle may be obtained by correspondingly increasing the number of condensers in each set and providing the cylinder with additional electrodes.

In both modifications of my invention the several coöperating electrodes may be in actual metallic engagement, or as shown, separated by a gap sufficiently small to be bridged by the potential impressed upon the terminals thereof.

In both modifications of my invention herein selected for illustrating the principle thereof, the plurality of discharges in the sonorous circuit for each half-cycle of alternating current in the power circuit is secured by the coöperation of stationary electrodes connected to the terminals of the sonorous circuit with a plurality of electrodes rotating in synchronism with the source of said current, the rotating electrodes being greater in number than the poles of said source. In both cases the equal separation with respect to time of the discharges, is secured by spacing the rotating electrodes equally about the axis of their rotation. In the apparatus shown in Fig. 1 the adjustable rocker-arm is instrumental in causing the discharges to occur at the same potential while in the apparatus shown in Fig. 2 this result is effected by the arrangement of the electrodes D with respect to the plates F and F′, the connections of all the condensers in a set with the power circuit transformer being simultaneously broken by one of the plates F F′ passing out of contact or coöperating position with the electrodes D of said condensers. The function of the rocker-arm 6′ in Fig. 2 will therefore be seen to be different from that of the rocker-arm 6 in Fig. 1 and it will be noted that in the apparatus shown in Fig. 2 the several condensers which constitute a set may be charged to the maximum potential of the alternating current, whereas in the apparatus shown in Fig. 1 the condenser C necessarily is charged with a potential less than said maximum.

It will be understood that many modifications may be made both in the apparatus and circuit arrangements herein described without departing from the principle of my invention.

I claim:

1. In combination, a sonorous circuit, a source of alternating current associated therewith, and a circuit-controller having means for securing a plurality of practically equally spaced discharges of substantially the same potential in said sonorous circuit for each half-cycle of said alternating current.

2. In combination, a sonorous circuit, a source of alternating current associated therewith, a discharger in series with said sonorous circuit, said discharger comprising two sets of electrodes, one of said sets of electrodes being arranged to secure a plurality of equally spaced discharges in said sonorous circuit for each half-cycle of said alternating current, means for creating relative motion between said sets of electrodes in synchronism with said source of alternating current, and adjusting means for one of said sets of electrodes whereby said discharges are caused to occur at substantially the same potential.

3. In combination, a plurality of condensers, means for charging the same simultaneously, an inductance coil and means whereby said condensers may be discharged successively through said inductance coil,

said inductance coil and each condenser so discharged therethrough constituting for the time being a sonorous circuit.

4. In combination, two sets of condensers, means for charging said sets of condensers successively, an inductance coil and means whereby the several condensers of each set may be discharged successively through said inductance coil, said inductance coil and each condenser so discharged therethrough constituting for the time being a sonorous circuit.

5. In combination, a plurality of condensers, means for simultaneously connecting the same in parallel with each other and in series with the source of alternating current, an inductance, and means whereby said condensers may be successively connected in series with said inductance.

6. In combination, two sets of condensers, means for simultaneously connecting the condensers of one set in parallel with each other and in series with a source of alternating current during one half-cycle of said alternating current, means for simultaneously connecting the condensers of the other set in parallel with each other and in series with said source of alternating current during the next half-cycle of said alternating current, an inductance, and means whereby the condensers of one set may be successively connected in series with said inductance while those of the other set are being connected in series with said source of alternating current.

In testimony whereof, I have hereunto subscribed my name this 3rd day of May 1909.

SEWALL CABOT.

Witnesses:

E. B. TOMLINSON,

GEO. K. WOODWORTH.