Nov. 25, 1930. F. E. MILLER 1,782,542

ELECTRICAL TONE PRODUCER WITH UNIVERSAL AUDION

Filed June 18, 1925 2 Sheets-Sheet 1

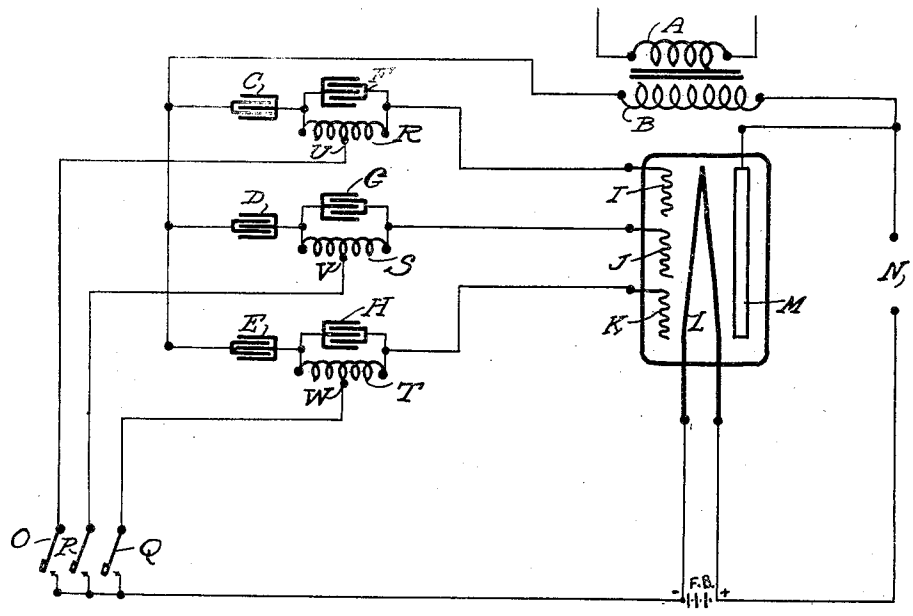



FIG. 1.

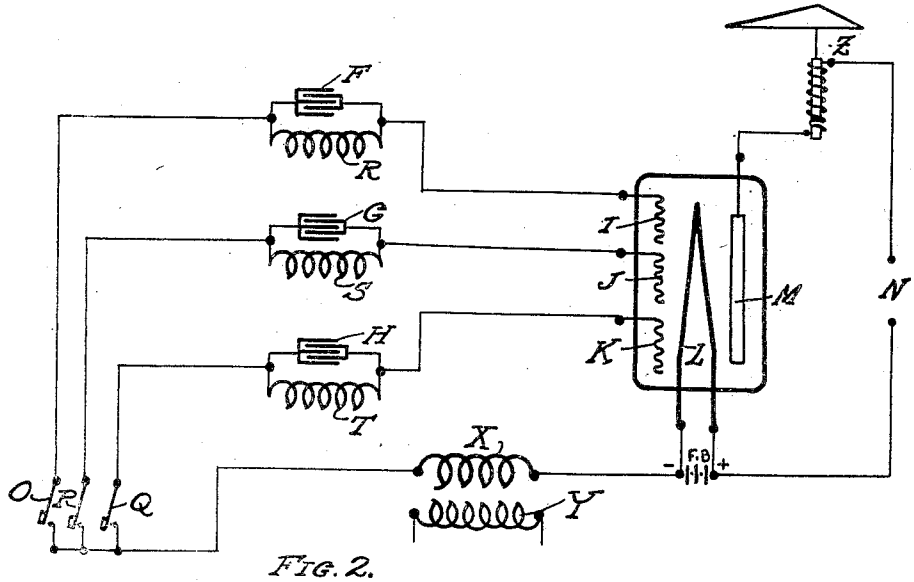



FIG. 2.

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ELECTRICAL TONE PRODUCER WITH UNIVERSAL AUDION

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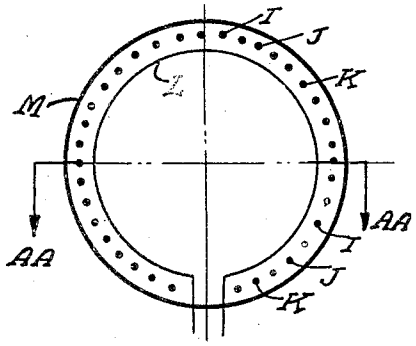



FIG. 3.

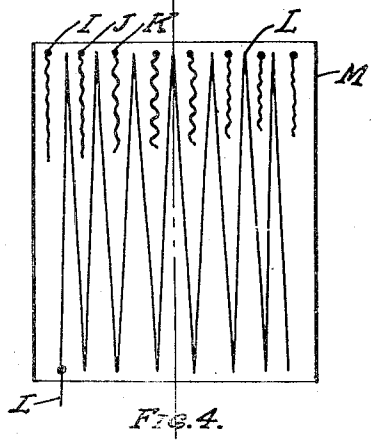



FIG. 4.

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Patented Nov. 25, 1930

1,782,542

# UNITED STATES PATENT OFFICE

FRANK E. MILLER, OF NEW YORK, N. Y.

## ELECTRICAL TONE PRODUCER WITH UNIVERSAL AUDION

Application filed June 18, 1925. Serial No. 37,984.

My invention relates to a system for producing musical sounds and tones, and also for use in testing the individual ear capacities for any desired purpose, as for example, by a surgeon or physician in the treatment of a patient's ear, or functions of hearing. The general basis and principle of my invention has been covered in Patent No. 1,376,288, dated April 26, 1921, on an Electrical system for producing musical tones, and my disclosure herein is a refinement and adaptation of said prior disclosure contained in the said patent. These refinements consist in the use of a specially constructed vacuum tube containing a plurality of elements which are correlated with my circuits to produce musical tones or notes of given frequencies, and thereby eliminate the necessity of using a multiplicity of individual vacuum tubes. The objects of my invention will be better understood from the illusrative embodiment described in the following specifications, and shown in the accompanying drawings, which form a part of this application, in which like letters refer to like parts in the several figures, and in which Fig. 1 is a diagrammatic wiring diagram of my system shown for a limited number of frequencies, and in which the vacuum tube and circuits are so arranged that they supply their own oscillating energy. Fig. 2 is a diagrammatic wiring diagram of my "universal vacuum tube" for a limited number of frequencies, in which an external source of oscillating energy is shown. Fig. 3 is a plan view of one method of design of a vacuum tube which I use, whilst Fig. 4 is a cross section of same, along the plane AA.

Referring to Fig. 1, each grid I, J and K is respectively separately tuned by the capacities and inductances F and R, G and S, and H and T respectively. These inductances are respectively severally connected at the points U, V and W to the keys O, P and Q, and thence by common return to the filament L and the filament battery FB. These groups of capacities and inductances are also respectively severally connected to the plate circuit through the blocking condensers C, D and E, and the various tones or electrical frequencies are fed to the reproducer through the output transformer having a primary B and a secondary A. The plate M and its circuit is energized by the plate potential N. The common wire from the keys makes the grid return for each grid, when the designated key is pressed for the particular tone to be reproduced.

In Fig. 2, a similar circuit with my Universal Audion is disclosed, except that an external source of oscillating energy is supplied through the transformer having a primary input coil Y and a secondary coil X; and I also show a typical reproducer Z. An alternating current electric generator, or a vacuum tube may be used for supplying the input current to the primary Y.

In Fig. 3, a plurality of grids, three of which are designated I, J and K, are shown in juxtaposition to one embodiment of a circular plate M and filament L, which is shown in cross-section elevation through the plane AA in Figure 4. The operation of these circuits is substantially similar to the operation described in my previous patent, except that in the method herein disclosed, I utilize a plurality of grids in one vacuum tube or audion, in place of a plurality of individual audions. I have shown typical key contact connections to regulate the various circuits, but it is, of course, to be understood that I may use other means, such as well known revolving disc contact means for automatically reproducing musical tones, and in this disclosure, I also provide for the more advantageous playing and reproduction of two or more tone frequencies simultaneously.

It must be understood that I do not confine myself to the disclosure of the particular type of universal audion shown in the drawings, but that other tubes containing pluralities of cold electrodes may be used, and are within the scope of my invention, as covered by the disclosures made here, and by the claims.

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

1. An electrical tone producer, comprising an audion containing a predetermined

number of grids and each grid connected to its respective circuit and grid connections, circuits associated therewith, and means included in said circuits for producing any desired number of musical notes.

2. An electrical tone producer including an exhausted vessel containing a hot electrode, and three or more cold electrodes, circuits associated with the cold electrodes, and means associated with said circuits for producing any desired number of musical notes of any desired pitch.

3. An electrical tone producer comprising an audion having a predetermined number of grids and each grid connected to its respective circuit and grid connections as a generator of electrical oscillations, and circuits connected therewith, and a plurality of external reactances and means for inserting one of said reactances in one of said circuits.

4. An electrical tone producer of the type described comprising an audion; said audion containing a predetermined number of grids, each grid connected to a separate circuit, means for automatically adjusting the impedance of each of said circuits, said audion having a single plate, a source of electrical energy and means for operating said automatic impedance adjuster to produce sounds of ascending or descending frequencies above, within and below the range of audibility.

5. In a system for exciting an audion, having a predetermined number of grids and each grid connected to its respective circuit and grid connections, selectively in response to oscillations of various predetermined frequencies; the combination of such an audion with one or more auxiliary condensers in each of said grid circuits; circuit connections between all said condensers and said grids comprising capacities and inductances and means for connecting said auxiliary condensers selectively in series with the hot electrode of said audion.

6. In a system for producing predetermined musical sounds, an audion having a predetermined number of grids and each grid connected to its respective circuit and grid connections, a plurality of circuits, each having capacities or inductances selected and proportioned relatively to the frequency characteristic of the desired predetermined musical sound; a source of vibrating electrical energy, an electrically operatable sounding member for reproducing the desired predetermined musical sounds under the influence of said audion, and means for making said selective circuits separately or jointly operatable.

7. An electrical device of the type described having a single vacuum tube, said tube containing a predetermined number of grids, each grid connected to a separate circuit, means for adjusting the impedance of each said circuit, said tube having a single plate by means of which the effects produced by the grids coacting with the filament are integrated to produce a chord of music to sound in a loud speaker.

In witness whereof, I have hereunto signed my name, this 20th day of May, 1925.

FRANK E. MILLER, M. D.