

F. E. MILLER.
 ELECTRICAL SYSTEM FOR PRODUCING MUSICAL TONES.
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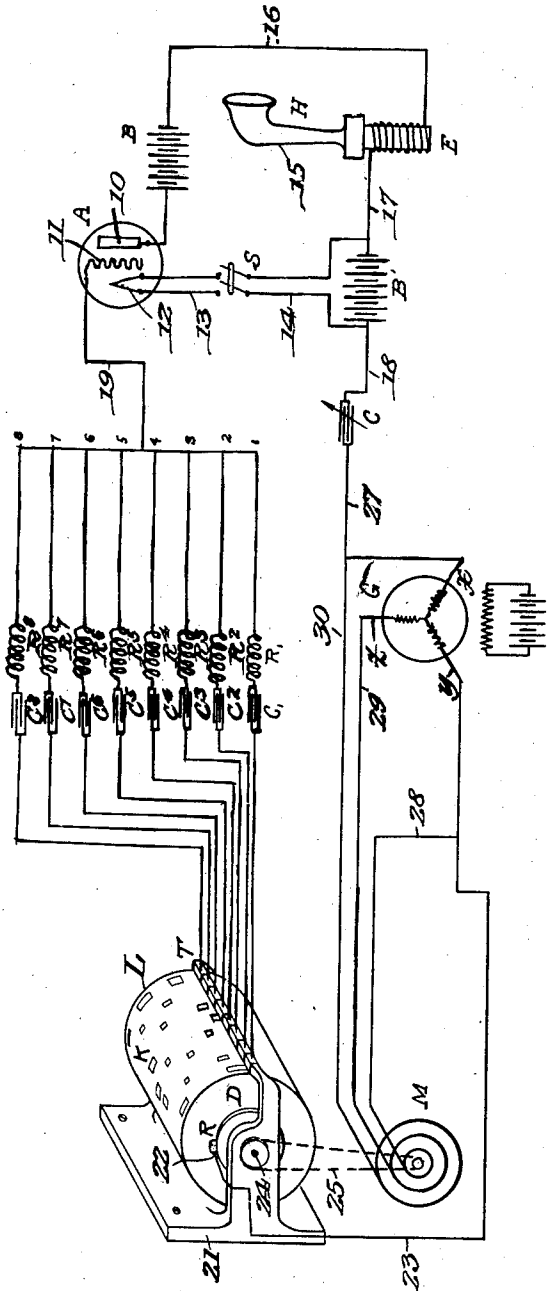


Fig. 1.

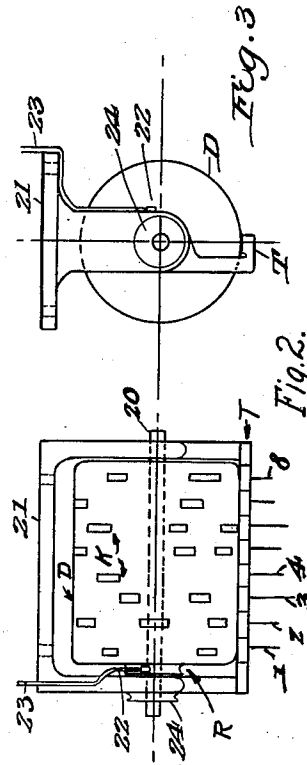


Fig. 2.

Frank E. Miller

INVENTOR

WITNESSES:
 Grace L. Kelly
 Florence H. Allen

UNITED STATES PATENT OFFICE.

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

ELECTRICAL SYSTEM FOR PRODUCING MUSICAL TONES.

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To all whom it may concern:

Be it known that I, FRANK EBENEZER MILLER, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented a new and useful Electrical System for Producing Musical Tones. The following is a description of it.

My invention relates to a system for producing musical sound. The object of my invention is to produce pure toned musical sounds of any desired frequency by exciting an audion in response to electric pulsations or oscillations of a predetermined frequency controlled by the selection and proportioning of capacity and inductance in the exciting circuit and independently of the frequency of an alternating current electric generator. I am aware that musical sounds have heretofore been produced by employing electric currents having a frequency characteristic of the generator producing them and equal to that required for the desired sound. I am also aware that an audion has been employed to magnify the oscillations received from such sources as both wire- and space-telephone lines, so that the amplified oscillations could be reproduced audibly in a telephone receiver. These heretofore reproduced sounds, however, have been characteristic of the source of the original sound, as, for instance, the human voice.

My invention differs from what has been done heretofore in that I employ an exciting circuit for the audion which in itself is the electrical equivalent of a musical sound and which must reproduce its own characteristic whenever operatively energized by a suitable source of electric energy.

A further object of my invention is to employ an audion under the control of a plurality of exciting circuits, each having a characteristic frequency capable of reproducing one of various selected musical sounds, for example, a plurality of circuits characteristic of the chromatic scale.

By exciting the audion selectively through various ones of these exciting circuits, I am capable of reproducing the desired musical sounds in a desired sequence, or, in other words, in reproducing monophonic music, or music in which fundamentals follow each other in sequence or tone succession.

In carrying out my invention, I propose to employ an electrically operable sounding member such as an electric horn for actually

producing the musical sound, or rather for translating it from an electric vibration into an audible mechanical vibration.

Further objects of my invention are to improve in general the arrangements of circuits and apparatus employed in connection with the use of the audion as an amplifying device.

The above and further objects of my invention will be set forth more in detail in the accompanying claims and will be understood from the illustrative embodiment described in the following specification, and shown in the accompanying drawings which form a part of this application, in which like characters represent corresponding parts in the several figures, and in which Figure 1 is a diagrammatic view of the entire system; Fig. 2 is a diagrammatic top plan view of the automatic plural contact circuit closer; and Fig. 3 is an end view of the controller shown in Fig. 2 looking from the left toward the structure as shown in Fig. 2.

A commercial audion A of suitable size for the electric currents to be employed is illustrated as containing the usual elements, 10 the plate, 11 the grid, and 12 the incandescing filament for effecting ionization. The local circuit 13—14 for heating the filament 12 is supplied with energy from the battery B' and may be opened and closed by the double pole knife-switch S. H is a suitable electrically operable sounding member and may be of the well-known type having an amplifying horn 15 and a sound producing diaphragm operated by the electro-magnetic means E. Member H is connected to one of the elements of the audion A by the wire 16 and to another element of the audion A by the wire 17 and the circuit wires 14 and 13 also employed for heating the filament 12. A source of direct current B shown in the form of a battery may be employed advantageously in the circuit for the member H as illustrated. Major condenser C is connected by the wire 18 and through the medium of the circuit 13—14 with the element 12 of the audion A and through the same medium (circuit 13—14) and through the battery B' with the wire 17, and through the circuit of the member H with another element 10 of the audion A.

The remaining element 11 of the audion A is connected through the wire 19 in common to one end of each of the selector circuits 1, 2, 3, 4, 5, 6, 7 and 8. The other end

of each selector circuit terminates in one of the respective units of a bank T of suitably insulated contacts of the automatic plural contact circuit closer L. Each of the selector circuits, 1 to 8 inclusive, is shown including in series an auxiliary condenser C_1 and an inductance producing device R_1 for circuit 1; C_2 and R_2 for circuit 2; C_3 and R_3 for circuit 3; C_4 and R_4 for circuit 4; C_5 and R_5 for circuit 5; C_6 and R_6 for circuit 6; C_7 and R_7 for circuit 7; and C_8 and R_8 for circuit 8. Each capacity such as C_1 and each inductance such as R_1 is selected and proportioned so that when employed with the circuit and the apparatus illustrated, a predetermined musical sound of the desired pitch or frequency will sound from the horn 15. The selecting and proportioning of each condenser and inductance I have done experimentally, but understand that the same may be predetermined mathematically. In the selector circuits, 1 to 8 illustrated, the respective condensers and inductances are selected and proportioned so that when the audion A is excited through the selector circuits, then the chromatic scale in pure musical tones will be reproduced by the horn 15.

The rotary controller or plural contact circuit closer L may be of any suitable construction. As illustrated, a cylindrical drum D is mounted on an axle 20 which in turn is journaled in a suitable frame 21. Suitable provision is made so that limited contact portions K, suitably spaced and positioned cylindrically about the axis 20 are capable of coöperating with the individual contact pieces T. Each contact portion K is suitably connected to the collector ring R, which coöperates with the brush 22 suitably connected to the wire 23. The drum D may be driven at a suitable uniform speed through the medium of a reduction connection such as the pulley 24 and belt 25 from the synchronous motor M.

A suitable source of electric energy is indicated by G. The illustration in the diagram is of a three phase alternating current generator. One phase between terminals X and Y is connected between the controller L and the major condenser C by the wires 23, 26, and 27. Suitable connections 28, 29, and 30 are also illustrated for energizing the motor M.

The arrangement of the contact portions K may be such that the selector circuits 1 to 8 are connected in series with the condenser C and the source G, one selector circuit at a time, and in such sequence as to produce any desired monophonic music. The duration of each musical sound is limited to the duration of contact between one of the portions K and one of the contact pieces T.

I have effected a considerable economy in condensers by employing a major condenser C which is operative in common to each and

every one of the selector circuits 1 to 8 inclusive. This major condenser C may be considered as sufficient to produce a frequency characteristic of the highest frequency to be employed for the collection of selector circuits illustrated, assuming that the capacity of condenser C_1 , for instance, is zero. To produce the next note of the series the effect of one of the auxiliary condensers such as C_2 is added to that of the major condenser C by connecting them in series as is effected by the controller L. Otherwise, without a major condenser C, it would be necessary that each of the condensers C_1 , C_2 , C_3 , C_4 and so forth be of a capacity within itself capable of producing the desired frequency of oscillation or vibration of electric energy necessary for the desired musical sound.

By multiplying the sets of 8 selector circuits and apparatus responsive thereto, a single controller L, with an appropriate increase of contacts T and contact portions K, may produce chordal music or music comprising selected groups of harmonious tones.

The constant speed motor M adapts itself most desirably in the system when it is desired to play an actual tune, although it is to be understood that the motor illustrates generically means for operating the controller. It is conceived that my system may be put to other uses than the reproduction of musical pieces, for example, the system may be of great use in testing the aural capacity of a patient by an expert surgeon or member of the medical profession. It is to be understood that the system and apparatus illustrated and described are merely for the purpose of illustrating a satisfactory manner of practising my invention, while I contemplate that many features thereof, as set forth in the following claims, are susceptible of modification.

What is claimed and what is desired to be secured by United States Letters Patent is:

1. In a system for producing selected musical sounds, an audion; a plurality of selector circuits each containing capacity and inductance selected and proportioned relatively to the frequency characteristic of a desired musical sound; a source of electrical energy for said circuits; an electrically operable sounding member separate and distinct from said audion and connected with said circuits for producing the desired musical sound under the influence of said audion; and means for making said selector circuits active selectively.

2. In a system for producing selected musical sounds in a pre-determinable sequence, an audion; a plurality of selector circuits each containing capacity and inductance selected and proportioned relatively to the frequency characteristic of a particular musical sound, each of said selector circuits

being commonly connected at one end to one of the elements of said audion; a source of electrical energy connected at one terminal with a second element of said audion; a plural contact circuit closer for connecting the other terminal of said source selectively first through one and then through another of said selector circuits; and an electrically operable sounding member electrically connected with said audion for producing, in sequence, the pre-determined musical sounds.

3. In a system for producing selected musical sounds in a pre-determinable sequence, an audion; a plurality of selector circuits each containing capacity and inductance selected and proportioned relatively to the frequency characteristic of a particular musical sound, each of said selector circuits being commonly connected at one end to one of the elements of said audion; a source of electrical energy connected at one terminal with a second element of said audion; a plural contact circuit closer comprising a rotatable member having cylindrically positioned contact portions for connecting the other terminal of said source selectively first through one and then through another of said selector circuits; a motor for driving said rotatable member; and an electrically operable sounding member electrically connected with said audion for producing, in sequence, the pre-determined musical sounds.

4. In a system for exciting an audion selectively in response to oscillations of various predetermined frequencies, an audion; a major condenser; one or more auxiliary condensers; circuit connections between all said condensers and said audion; and means for connecting said major condenser selectively in series with any one of said auxiliary condensers.

5. In a system for producing musical sounds the combination of an audion, a plurality of selector circuits each adapted to be momentarily connected with said audion, each selector circuit having its constants so apportioned that in connection with said audion it will acquire a fundamental time period of discharge corresponding to the acoustical vibrations of a musical note, the several time periods of the selector circuits corresponding to the various notes of the musical scale, means for connecting the several selector circuits in a pre-determined order of succession with said audion, and a source of electricity for energizing said audion and said selector circuits when so connected.

6. In a system for producing musical sounds the combination of an audion, a plurality of selector circuits each adapted to be

momentarily connected with said audion, each selector circuit having its constants so apportioned that when connected with said audion it will acquire a fundamental time period of discharge corresponding to the acoustical vibrations of a musical note, the time periods of the said selector circuits corresponding to the various notes of the musical scale, controller mechanism for automatically connecting the several selector circuits in a pre-determined order of succession with said audion, and means for energizing said audion and said selector circuits.

7. An electrical tone producer including an audion as a generator of electrical oscillations and circuits associated therewith, and a plurality of artificial resistances and means for inserting any one of said resistances in one of said circuits.

8. An electrical tone producer comprising an audion, circuits associated therewith, and means included in said circuits for producing any desired number of musical notes.

9. An electrical tone producer including an exhausted vessel containing hot and 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.

10. An electrical tone producer including an exhausted vessel containing hot and 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, and independent means to regulate the pitch of said notes.

11. An electrical tone producer including an exhausted vessel containing hot and cold electrodes, circuits including inductance and capacity associated with the cold electrodes, means for producing any desired number of electrical notes, and means for varying the capacity in one of said circuits.

12. An electrical device of the class described, comprising an audion and suitable circuits, and a source of energy and means associated with said circuits to produce tones of ascending pitch.

13. An electrical tone producer including an audion and a plurality of circuits associated therewith, and a plurality of artificial resistances adapted to be included in one of said circuits and means for altering the artificial resistance in accordance with the pitch of the note to be produced by cutting in any number of said resistances.

FRANK EBENEZER MILLER.

Witnesses:

GRACE L. MCKELVEY,
FLORENCE H. AIKEN.