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CATHODIC COUPLING OSCILLATOR FOR ELECTRONIC MUSIC INSTRUMENTS

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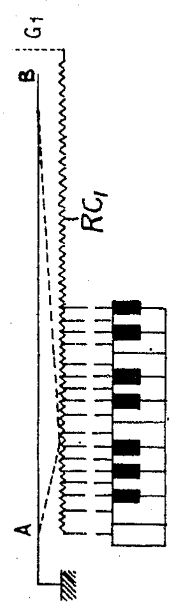

Fig. 3

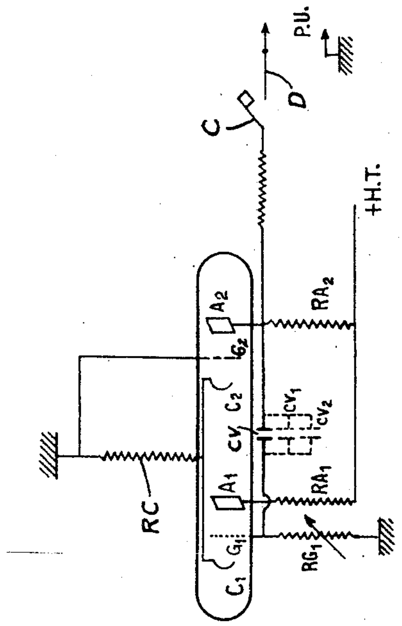

Fig. 1

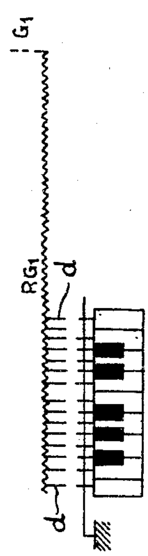

Fig. 2

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CATHODIC COUPLING OSCILLATOR FOR ELECTRONIC MUSIC INSTRUMENTS

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My invention relates to the generation of undamped audio frequency oscillations in electronic musical instruments.

It is an object of the present invention to provide an oscillating system of high stability.

It is a further object of my invention to provide oscillations which contain a large amount of harmonics.

Another object of the present invention is the provision of simple and effective tuning and operating mechanisms for controlling the pitch of each tone as well as for shifting the tone range covered by the instrument.

Still another object is the separate and independent control of frequency intervals in response to the operating mechanism and the frequency range covered by the instrument.

It is a still further object of my invention to provide an adjustable capacitive-resistive oscillator output coupling impedance.

The electronic musical instrument according to this invention comprises an electron tube system for generating audio oscillations. In this system two triodes, which may be contained in the same envelope, have their cathodes electrically connected, the grid of one triode being connected to the anode of the other triode. The grid of one triode is grounded through a variable resistor, while the grid of the other triode is connected to ground in any conventional manner.

The variable resistor inserted between the one grid and ground may be controlled, for instance, by the operation of a keyboard or by means of a metallic cord or band, grounded at one end. Provisions for alternative control may be made.

Tunable capacitors may be used for tuning the oscillating system.

Further I propose to insert a resistive-capacitive impedance between the tunable oscillator and the subsequent audio frequency amplifier. This impedance is constituted by an asbestos armature and a metal armature adapted to contact and to compress the asbestos, whereby the impedance of the asbestos, which is a function of pressure, is varied.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a wiring diagram illustrating a cathodic coupling oscillator according to my invention;

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Figs. 2 and 3 show two embodiments, respectively, of the keyboard and associated elements.

As shown in Fig. 1, I preferably use a double triode, 6 C8. The two cathodes C1 and C2 of this double triode are interconnected, and grounded through a biasing resistance R C. The grid G2 is either grounded, as shown in Fig. 1, or connected to ground by a resistance of small value. A variable tuning resistance R G1 between the grid G1 and the ground is inserted. G1 is connected to anode A2 through an adjustable capacity C V. The anode A1 and the anode A2 are connected to the voltage source, respectively, through the load resistances RA1 and RA2. The connection between this oscillating system and a low frequency amplifier of any type adapted to amplify and transform the electric oscillations into acoustic vibrations is established by a special resistive-capacitive impedance constituted by an asbestos armature C and a metal armature D adapted to be moved toward one another for contacting, these armatures being inserted between either anode A2 or A1 and the input grid of the subsequent amplifier P. U. (Fig. 1).

The above-described connections produce undamped oscillations at audio frequency as required in electronic musical instruments. Modifications may be introduced, for instance by the incorporation of capacities in parallel with R C or the incorporation between G2 and ground of a variable resistance. Instead of a double triode, I may use two separate triodes, two pentodes or similar tubes, the main feature of the oscillating system being in all cases the cathodic coupling obtained through the electric connection between the two cathodes C1 and C2. The onset of the oscillations is obtained through this coupling which may be effected either through a direct connection between C1 and C2 or by means of a resistance or induction coil. The auxiliary features illustrated in the wiring diagram of Fig. 1 are the omission of the conventional induction coil which is a general feature in the oscillating systems now in use; furthermore one of the grid electrodes G2 is grounded. It will be understood that additional induction coils, capacities or resistances may be added at different points as disclosed hereinabove without changing substantially the circuit shown in Fig. 1. The electronic musical instruments schematically illustrated in Fig. 1, permits various different modifications and embodiments which, due to the cathodic coupling all have the following performance features:

(a) excellent frequency stability;

(b) a basic sound extremely rich in harmonics thus allowing a large variety of tones to be obtained by subsequent filtering;

(c) for a given value of C V (Fig. 1) it is possible, through variation of R G1, to obtain a continuous variation in frequency between beats and the upper limit of the sharpest audible sounds and even beyond. Conversely, for a given value of R G1, I obtain the same range through a variation of C V;

(d) the frequency shift obtained through an adjustment of the variable resistance R G1 is not affected, when the frequency range is raised or lowered by an adjustment of C V. Similarly, the frequency shift associated with shunting of C V by condensers C V1, C V2, etc., will not be affected by a variation of R G1 which modifies the frequency range covered.

These advantages are used together or separately in the apparatus to be described hereinafter. However, any other form of instrument incorporating these particular means for modifying sound disclosed hereinabove falls within the scope of the present invention.

In a first embodiment, Fig. 2, I have illustrated a piano keyboard of three or four octaves. In this case R G1 is constituted by a long graphite resistance provided with movable collars. Each collar is connected to a contact d actuated by a keyboard key. When a key is depressed, the point on the resistance to which the associated collar is secured is grounded through the closing of the contact. The collars correspond to one half tone intervals of the musical scale, and the preliminary tuning of each half tone is accomplished by displacing the collar in either direction along the resistance. The general tuning, i. e. the displacement of all notes on the instrument by one quarter of a tone, one half tone or one third higher is obtained by operation of the adjustable condenser C V. Additional shunting condensers such as C V1, C V2 allow an immediate transposition one; two, three or more octaves higher. In practice, the apparatus covers 7 or 8 octaves with a keyboard of three octaves. The vibrato is obtained by acting on C V or on R A1 or on R A2.

In a second embodiment relating to a small accordion keyboard, each keyboard key controls the shunt insertion of small adjustable condensers such as C V1, C V2, tuning by semi-tones. The keyboard system is carried by a movable board adapted to rotate round an axis and allowing a displacement of the keyboard to the right or to the left. This lateral displacement operates the variable resistance R G1. Consequently sliding during the playing is possible, which is similar to changes in position on the violin. The same may be the case for producing a vibrato.

In a third embodiment, Fig. 3, corresponding to an electronic clavichord associating strings with a keyboard, I associate a keyboard of the type illustrated in Fig. 2 with a grounded metal string or strip A B stretched above the resistance R G1 which may be coiled. It is possible to play either on the keyboard or by pressing with the finger on a point of the string A B to contact the resistance R G1, thereby grounding the resistance R G1 at the point of contact. When depressed, the string A B will assume the position indicated by the dotted line in Fig. 3. By sliding the pressing finger along the string, I obtain a glissando in a manner similar to the playing of the violin. Thus the same resistance R G1 may be controlled by either the keyboard or the string. The instrument is tuned through operation of variable condensers, such as C V, C V1, C V2.

What I claim as new and desire to secure by Letters Patent is:

1. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; and a condenser connecting the grid of said second element to the anode of said first element.

2. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; a condenser connecting the grid of said second element to the anode of said first element; a direct current source; and two resistances connecting, respectively, the anodes of said first and said second element to the positive terminal of said direct current source.

3. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; an asbestos resistance; and an amplifier connected by said asbestos resistance to the output of said vacuum tube system.

4. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; a keyboard including keys corresponding to semitone intervals; means for varying said resistance by the depression of said keys; and an adjustable condenser adapted to cooperate with said vacuum tube system for tuning the instrument.

5. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; a keyboard including keys corresponding to semitone intervals; means for varying said resistance by the depression of said keys; an adjustable condenser adapted to cooperate with said vacuum tube system for tuning the instruments; and a plurality of condensers adapted to be connected

in parallel to said adjustable condenser for transposing the tuning.

6. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; a keyboard including keys adapted to control the variation of said resistance; and a grounded string adapted to contact said resistance whereby the pressure of the finger of the player on said string grounds said resistance at the point at which the finger acts.

7. In an electronic music instrument in combination, an oscillatory vacuum tube system tuned to audio frequency; said system including a first and a second triode element each including a cathode, a grid, and an anode; an electrical connection between said cathodes; an electrical connection between the grid of said first element and ground; a variable resistance connected between the grid of said second element and ground; an amplifier, an asbestos resistance connected between said vacuum tube system and said amplifier; a keyboard including keys adapted to control the variation of said resistance connected to the grid of said second element; and a grounded string adapted to contact said resistance connected to the grid of said second element whereby the pressure of the finger of the player on said string grounds said resistance at the point at which the finger acts.

GEORGES JENNY.

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