Sept. 5, 1939. A. A. KUCHER 2,171,936

REPRODUCING APPARATUS AND METHOD

Filed Aug. 26, 1936 4 Sheets-Sheet 1

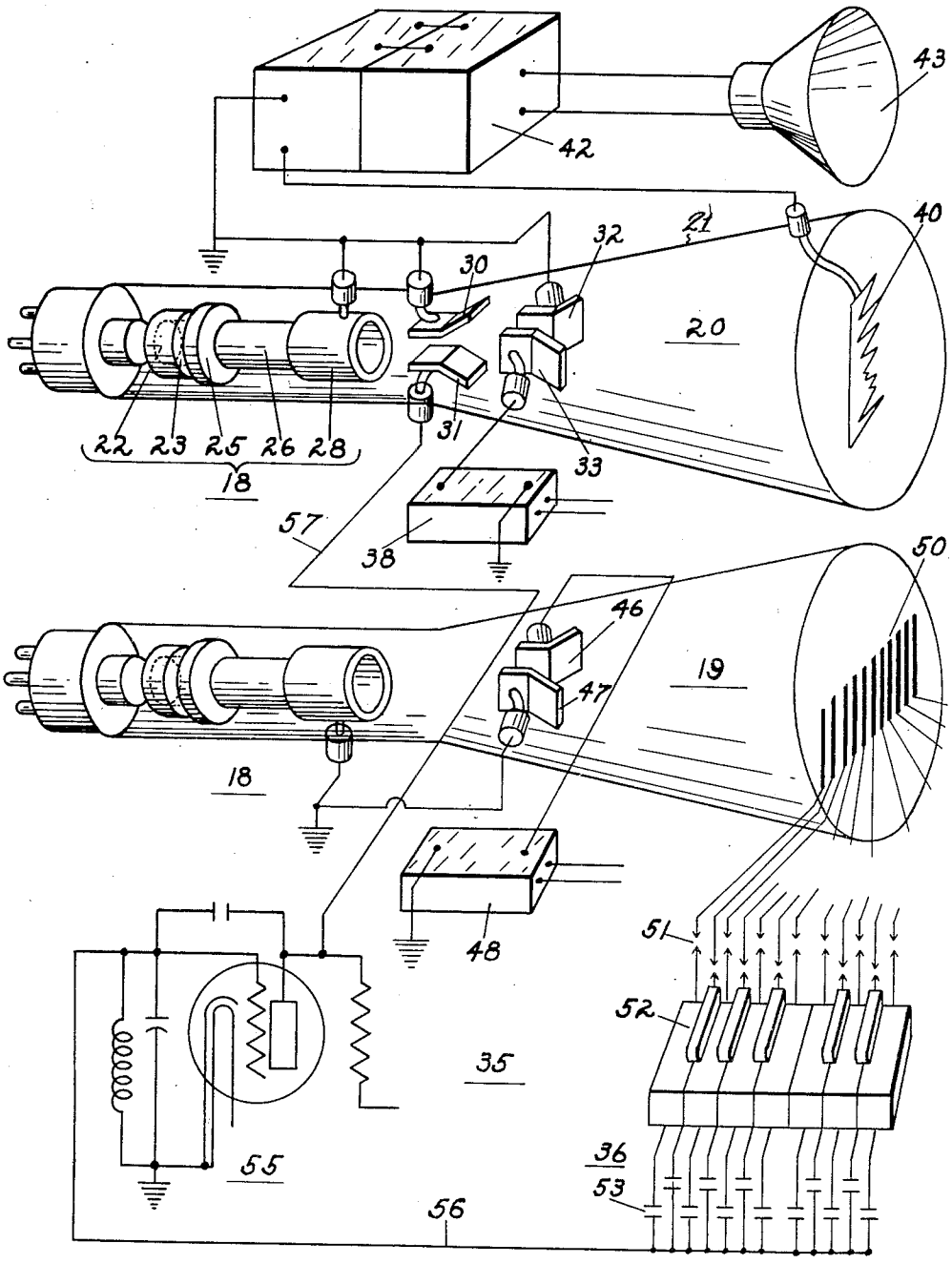


Fig 1

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REPRODUCING APPARATUS AND METHOD

Filed Aug. 26, 1936 4 Sheets-Sheet 2

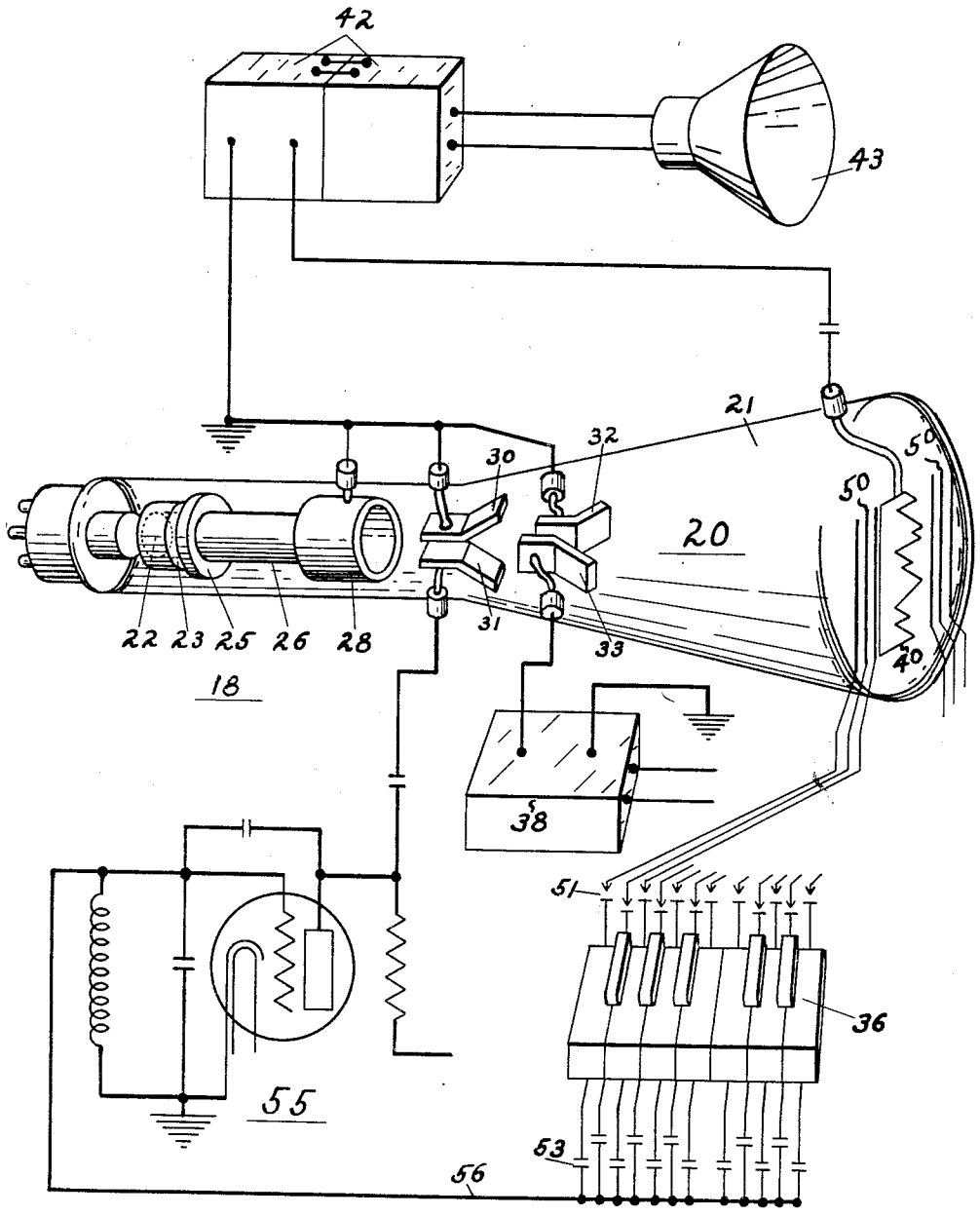


Fig 2

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REPRODUCING APPARATUS AND METHOD

Filed Aug. 26, 1936 4 Sheets-Sheet 3

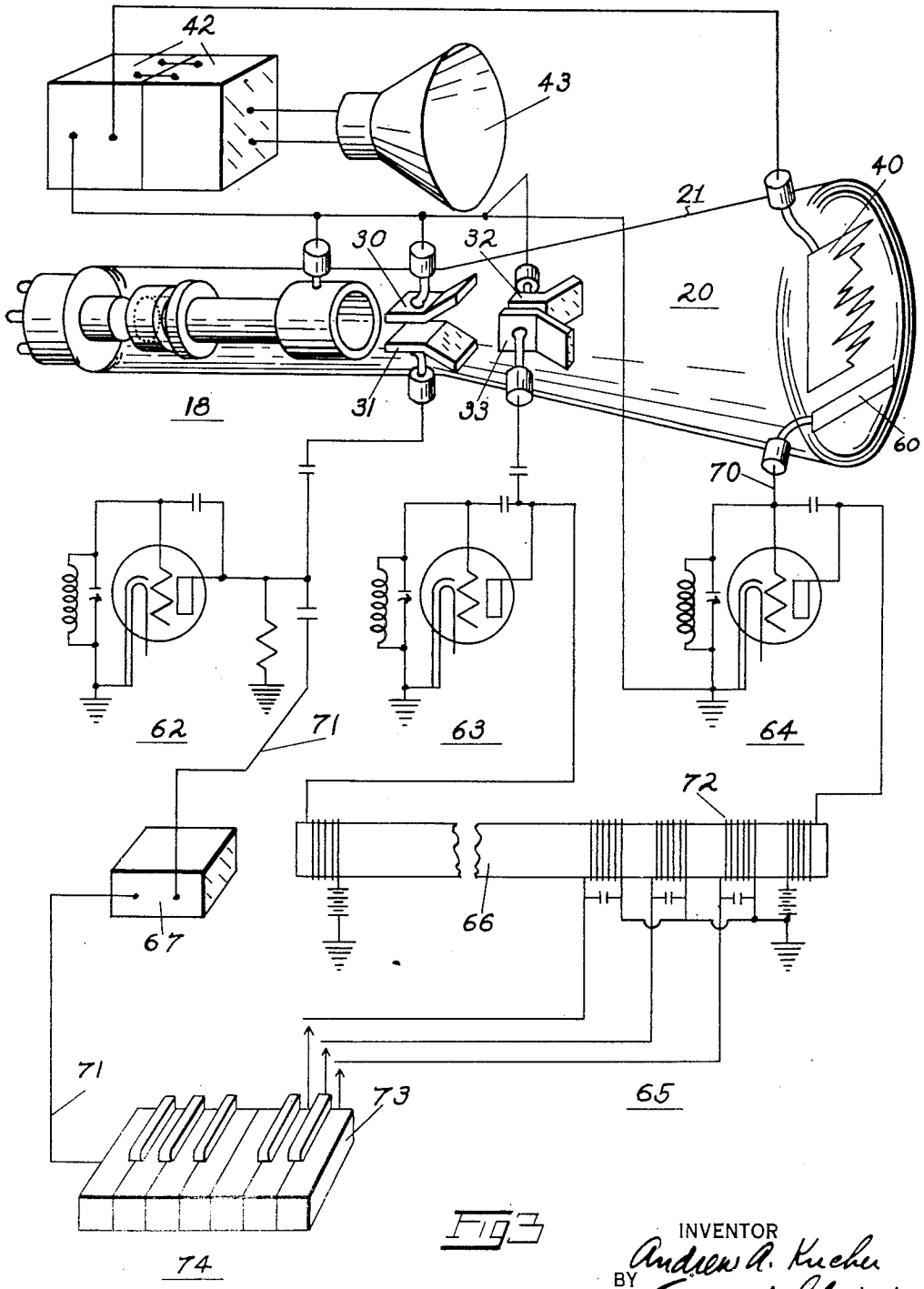


Fig 3

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REPRODUCING APPARATUS AND METHOD

Filed Aug. 26, 1936 4 Sheets-Sheet 4

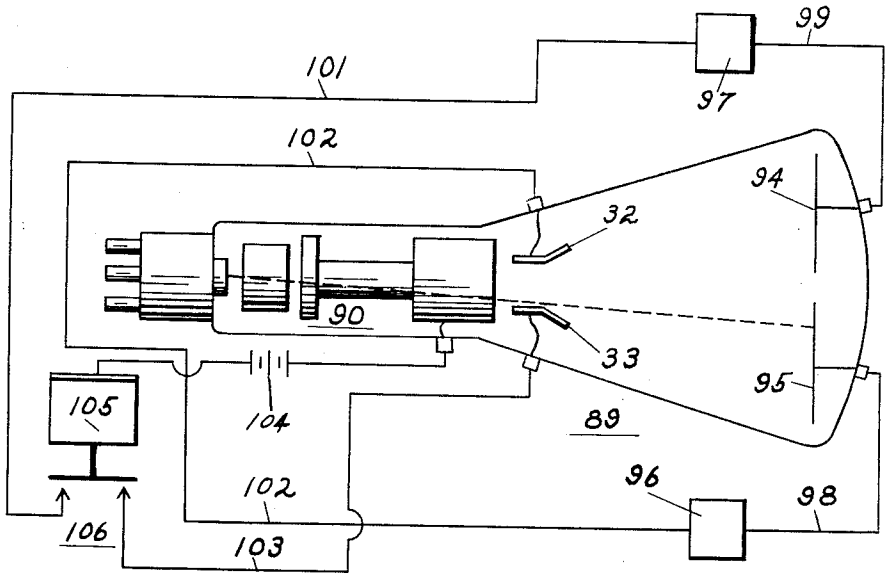


Fig 5

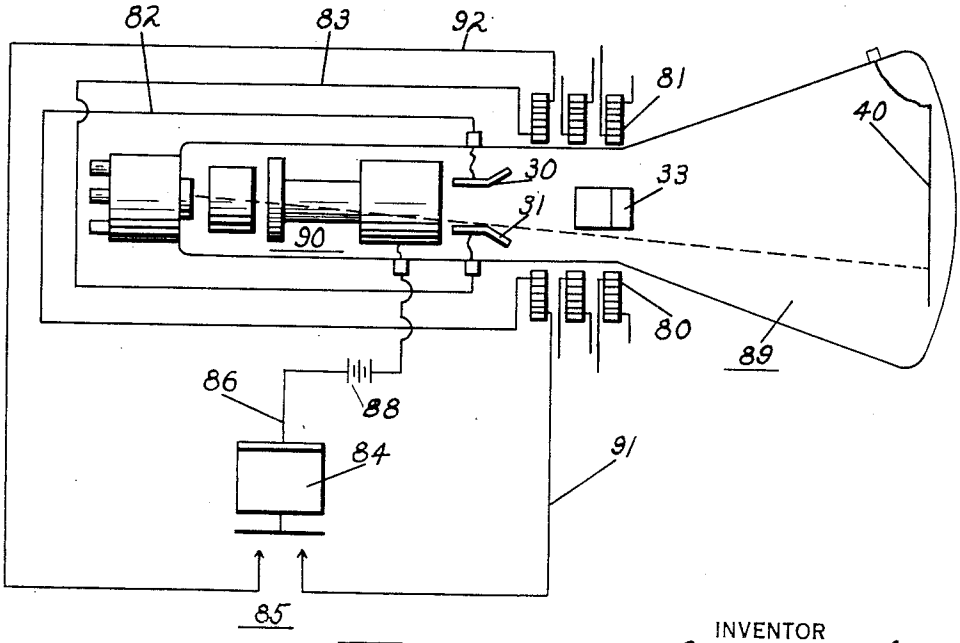


Fig 4

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UNITED STATES PATENT OFFICE

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REPRODUCING APPARATUS AND METHOD

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Application August 26, 1936, Serial No. 97,994

28 Claims. (Cl. 84—1.18)

The present invention relates to the method of and apparatus for producing oscillations of different frequencies simultaneously and it also relates to the method of and apparatus for utilizing such frequencies for producing musical tones.

The particular embodiment of the present invention is in connection with the utilization of a pattern of conductive material which approximates one complete cycle of the complex tones of a musical instrument from which all the notes of the musical instrument can be produced with all their complex tonal characteristics. This production of the tones is accomplished by causing electronic emissions to sweep the pattern at the fundamental frequency or frequencies of the notes to be produced to cause electrical impulses to be impressed in an associated tone reproducing apparatus.

In such apparatus it is necessary to provide frequencies within the entire musical scale so that the frequency of a note or the frequencies of a combination of notes are available concomitantly whereby chords can be produced.

One of the objects of the present invention is to provide a method of and apparatus for producing a range of frequencies concomitantly by causing electronic emissions to energize excitable means which is capable of producing a range of frequencies concomitantly.

Another object of the invention is to provide a method of and apparatus for producing a range of frequencies concomitantly within the audible range by causing electronic emissions, oscillating at an inaudible frequency, to energize a means which is excitable by the moving emissions and which is capable of producing a range of audible frequencies concomitantly.

In carrying out the above objects, it is another object to provide a method of and apparatus for producing a range of frequencies concomitantly by subjecting a device which is resonant to a source of constant inaudible frequency and which is also resonant to a source of constantly varying inaudible frequencies and which second source varies in frequencies from the first source so as to set up in the device a range of oscillations which can be picked up individually concomitantly by means resonant to varying differential oscillations.

Another object of the present invention is to provide a method of and apparatus for producing a range of frequencies concomitantly by causing the moving electronic emissions of an oscillator to periodically energize a plurality of contacts and cause circuits, which have different resultant effects on the oscillator, to be energized by the energization of the contacts so that the oscillator can be tuned selectively by controlling the circuit or circuits.

Another object of the present invention is to provide a method of and apparatus for producing a range of frequencies concomitantly by causing the moving electronic emissions of an oscillator to contact a plurality of contacts progressively and cause circuits which have different resultant frequencies to be energized by the contacts and controlling the energization of one or more of the circuits for oscillating the emissions at a desired frequency or desired frequencies.

A still further object is to incorporate a character pattern with the oscillators which pattern is formed of conductive material excitable by the electronic emissions and swept by said emissions at the desired frequency or frequencies produced by the oscillator to create electrical impulses embodying the complex character of the pattern and the imposed or superimposed frequencies of the sweeping emissions.

Other and further objects and advantages will be apparent from the following description, reference being had to the accompanying drawings wherein preferred forms of embodiments of the present invention are clearly shown.

In the drawings:

Fig. 1 is a schematic wiring diagram of a reproducing apparatus employing two cathode ray tubes, one of which acts as a variable frequency oscillator while the second tube includes a character pattern of the tone to be reproduced;

Fig. 2 is a similar circuit except the two cathode ray tubes shown in Fig. 1 have been consolidated so that only one tube is required to accomplish the dual function of reproduction and variable frequency oscillation;

Fig. 3 is a schematic wiring diagram of a reproducing apparatus using one cathode tube but having an external means for producing the desired frequencies of oscillation to be impressed on the vertical deflecting plates of the cathode ray tube, a resistance; a capacitance or other type of electrical reactance is disposed so that the rays of the tube sweep the reactance during the horizontal deflection, the variable resultant of the reactance being utilized in connection with the external oscillating means; a character pattern or profile is also included in association with the cathode ray tube;

Fig. 4 is another embodiment of a cthode ray tube utilizing external electro-magnetic deflecting means to direct the vertical deflection of the

beam; a series of magnets, in a series of circuits are used, each circuit causing a different frequency of oscillation of the emissions; a pattern in character form is also used with this embodiment; and

Fig. 5 is a self oscillating tube that may be substituted for the other forms of variable frequency oscillators described, the cathode ray tube in this case being provided with a series of discharge devices which are discharged by the deflection of the emissions and re-charged by electrical contact through the emissions to establish an instrument capable of self oscillation.

Referring first to the embodiment illustrated in Fig. 1, there is provided a plurality of tubes 19 and 20 for producing electronic emissions. These tubes are preferably cathode ray tubes similar to those employed in oscillographs and described in the book entitled "Cathode-Ray Tubes and Allied Types, Technical Series TS–2" published by RCA, Radiotron Division of RCA Manufacturing Company, Inc., of Harrison, New Jersey. The tube 20 is the same as that shown in my co-pending application Serial No. 65,443, filed February 24, 1936, and includes a glass envelope 21 that surrounds and seals the enclosed elements of the tube. The cathode 22 is surrounded by heater 23. The emissions of the cathode are then passed through an electrode 25 that accelerates the movement of the electronic stream and then through an electrode 26, which latter focuses or concentrates the emissions into a more condensed form. A high voltage electrode 28 further accelerates the movement of the emissions. All of the electrodes form an electron gun generally indicated at 18 and have the same general shape and in this manner the emissions are in which may be termed "in a line".

Two fields are provided for deflecting the emissions, for example, two sets of deflector plates are provided, one set being indicated as plates 30 and 31, and the other set including plates 32 and 33. The plates 30 and 31 are arranged to deflect the emissions passing therebetween vertically while the plates 32 and 33 are arranged to deflect the emissions passing therethrough transversely of the first deflection and, as is herein shown, are adapted to deflect emissions horizontally. Suitable oscillating means are connected with the respective deflector plates 30 and 31 and deflector plates 32 and 33 for creating the electrostatic fields. Either the first set of deflector plates 30 and 31 or the second set of deflector plates 32 and 33 may be energized at a fixed frequency and the other of the two sets operated at selected or concomitantly superimposed selected frequencies. In the specific embodiment herein shown, the first set of plates 30 and 31 are connected with an oscillator for producing selected or concomitantly superimposed selected frequencies. This oscillator is herein shown at 35 and the frequencies at which the oscillator operates are controlled and varied by a key manual such as a piano manual 36. For example, if the middle key of A is depressed the frequency impressed on the deflector plates 30 and 31, through the oscillator 35 will be approximately 440 cycles per second. In a like manner any note or combination of notes, such as a chord, desired can be transferred to the deflector plates 30, 31 at its, or their, own frequency or frequencies. In this instance two or more keys are depressed, substantially simultaneously, to cause the individual frequencies of the corresponding notes to be impressed simultaneously on deflector plates 30 and 31 through oscillator 35. It is of course understood when two or more keys are depressed to produce a chord, the individual frequencies imposed upon deflector plates 30 and 31 will be concomitantly superimposed. The operation of the various oscillator circuits as utilized to produce the desired range of individual frequencies in the oscillator 35 will be explained in detail hereinafter. Likewise in the embodiment shown in Fig. 1, the deflector plates 32 and 33 are connected to an oscillator 38 of fixed frequency. Preferably the frequencies of oscillations imposed to the emissions by plates 30 and 31 are within the audible range while the frequency imposed by plates 32 and 33 to the emissions by the oscillator 38 is above the audible range.

It will be apparent therefore that the oscillating electrostatic field across deflector plates 31 and 30 will cause the cathode emissions to oscillate vertically while the oscillating electrostatic field across the deflector plates 32 and 33 causes the electrode emissions to oscillate transversely, and as herein shown, horizontally. These moving or oscillating emissions are arranged to scan a pattern 40 of character form. It is apparent to those familiar with oscillographs that the width, heighth, and the reflected position of the emissions may be focused by various control means, commonly employed in an oscillograph as disclosed in the aforementioned book. With this in mind, the extent of oscillation of the emissions are held as not to be less than nor greatly in excess of the dimensions of the pattern.

The pattern may be formed of a plate fabricated in several different ways. The plate shown in Fig. 1 is conductive material such as nickel. Still another means is to coat the end of the tube with conductive material in character pattern. The profile of the pattern traces one complete cycle including the complex intensity relationship of the component harmonics of a musical instrument or synthetic combinations of audible frequencies.

The cathode ray emissions impinging on the pattern are arranged to sweep the pattern both vertically and horizontally, the deflector plates 30 and 31 causing vertical sweeps, preferably downwardly, at frequencies in the audible range, and the plates 32 and 33 causing horizontal sweeps at a relatively high frequency, for example, one million times per second. The resultant component of the relatively high horizontal sweeps and the relatively low vertical sweeps, of audible frequencies, cause a scanning of the entire pattern within the audible frequency range.

The activation of the conductive pattern 40 varies according to the area thereof being impinged by the emissions. As the emissions sweep horizontally at a high frequency and in recurring vertical sweeps, the activation of the pattern is varied in accordance with the character formation of the pattern. The conductive pattern 40 is in circuit with a detector-amplifying means diagrammatically shown at 42 through the emission of the cathode which impinges the pattern. The detector-amplifier is connected with a loud speaker 43. The pattern is disposed so that the controllable sweep, i. e., the sweep with audible frequencies, is lengthwise with the traced cycle.

The oscillator characteristic is an important factor in satisfactory tone reproduction. If the scanning is of sine wave character, for example, both downwardly and upwardly at varying velocity, then, in that event, the pattern should be interpolated so as to reproduce the character of

tone desired. However, it is desirable to use pattern of true cycle character, and in order to simulate continuous scanning, it is necessary to cause the cathode emissions to sweep the character pattern at a uniform velocity downwardly and, after one sweep is completed, to instantaneously return for the subsequent recurring sweep. The impressed audible oscillation on the deflector plates is, therefore, in the nature of a saw tooth as distinguished from a sine wave. Therefore, the oscillators to be used in conjunction with this apparatus will have the character of providing continuous scanning. Thus it will be seen that by applying the complex electrical impulses of the successive or recurring fundamental impulses of the tone or tones to be reproduced the activation of the conductive character is varied and then by transmitting this variation of activation to a detector-amplifier connected with a loud speaker, the detector-amplifier will be modulated so that tones, having the character of the pattern, can be reproduced.

It is apparent from the foregoing that the true tones of one or more instruments may be reproduced. The most pleasing tones when once recorded into a pattern are available and can be reproduced by an instrument which can be manufactured at a much lower cost than the parent instrument. This same reproducing instrument can be utilized for producing all the notes of a base viol, violin-cello, viola, and violin, and, all of these notes can be reproduced selectively individually or selectively concomitantly through the use of a pattern or patterns, by varying the frequency or frequencies of the electrostatic fields across plates **30** and **31**.

As previously stated the tube **19** is constructed similarly to tube **20** and is provided with the same type of electronic gun. However, this tube **19** is provided with only one set of deflector plates **46** and **47** and these plates are connected with a fixed frequency oscillator **48**, preferably oscillating a relatively high frequency of one million cycles or more per second. This oscillator **48** and plates **46** and **47** cause the emissions to sweep with a horizontal movement. The enlarged end of tube **19** carries or is suitably associated with a series of contacts **50**, preferably eighty-eight. These contacts are arranged so that they are swept progressively by the oscillating emissions, and, in a preferred form, they are arranged side by side and each extends vertically. Each contact is in a separate control circuit **51** actuated by a key **52** of the manual **36**. Each control circuit includes an electrical reactance **53**. Each reactance may be in the form of a capacitance, as shown, or it may be an inductance or resistance or any other suitable type of electrical metering device. An oscillating tube and its oscillating circuit **55** is connected by wire **56** in circuit relation to all of the keys **52** of manual **36**, the reactances **53** and contacts **50**.

The emissions oscillating at a relatively high frequency cause a substantially continuous energization of the contacts **50** so that when one or more of the switches **51** are closed by keys **52**, the circuit or circuits closed is placed in series circuit with the oscillating tube circuit **55**. The reactance **53** in each control circuit is different and balanced with the tube circuit **55** so as to produce a resultant frequency corresponding to the frequency of note desired by the key depressed. These oscillations are conducted by the wire **57** and suitable ground connections to the deflector plates **30** and **31** of the tube **20**. It will therefore be noted that there are eighty-eight circuits capable of being placed in series simultaneously with the oscillating tube circuit **55**. Each of these eighty-eight circuits is balanced with the tube circuit **55** so as to produce a different frequency of oscillation output from the tube, the frequencies corresponding; for example, to the frequencies of oscillation of the individual notes of the musical scale. As previously described, the frequency or frequencies impressed on the plates **30** and **31** regulates the frequency or frequencies of oscillation of the sweep of the emissions passing across the pattern **40**.

It is to be understood that the tube circuit **55** is capable of producing superimposed frequencies when two or more of the reactances of the control circuits are energized simultaneously. Thus a single note or any number of notes can be produced concomitantly by depressing one or more, as the case may be, of the keys **52**. In other words notes and chords are produced in the same manner as when playing a piano.

If desirable, one of the tubes can be omitted, namely tube **19**. This construction is shown in Fig. 2. In this embodiment, the contacts **50** are disposed in the plane of pattern **40** substantially perpendicular to the sweep emissions. Due to the fact that the emissions sweep the pattern vertically and at relatively low frequencies, it is desirable to elongate the contacts **50** so that they are contacted substantially constantly by the sweep emissions. For convenience, forty-four contacts are disposed on each side of the pattern. The oscillator **38**, in this embodiment, causes a substantial constant energization of the contacts **50** by its high frequency oscillation of the emissions. It is of course understood that in this embodiment, the focus of the beam emission is adjusted so that the horizontal sweep is of sufficient magnitude to include all of the contacts **50**.

In the embodiment shown in Fig. 3, the tube **20** is the same as in Fig. 1, including the electronic gun and sets of plates **30** and **31** for vertical deflection and plates **32** and **33** for horizontal deflection of the emissions and including the pattern **40**. This tube, in addition, has associated therewith a reactance **60** which is also scanned and variably energized by the emissions. The oscillating means in this embodiment includes three oscillating tubes and their associated circuits **62**, **63** and **64**, an amplifier **67** and a resonant pickup and associated circuits **65**. The resonant pickup includes a bar **66** the opposite ends of which are resonantly coupled so as to be responsive to frequencies impressed by the oscillators **63** and **64**. The oscillator **63** is tuned to oscillate at a frequency of, for example, one million times per second, and is suitably connected to the horizontal deflecting plates **32** and **33** and this same frequency is also impressed at one end of the bar **66**.

The tube circuit **64** is normally tuned to oscillate at a frequency of one million cycles per second. The circuit, however, is connected by wire **70** and a ground to the reactance **60** which is rendered variable to produce frequencies from zero to five thousand which are superimposed on the normal frequency of one million per second to produce variable resultant frequencies ranging from a million to a million, five thousand. These variable resultant frequencies are impressed, by resonant coupling, on the opposite end of the bar **66**. This variation of frequencies from one million to one million, five thousand cycles, occurs one million times per second. This is due

to the oscillation of tube circuit 63 acting on the emissions through the deflector plates 32 and 33.

The reactance 60 may take the form of an inductance, capacitance, or a resistance. For illustrative purposes, it can be considered as a resistance having the characteristics of a resistance in which resistance increases and decreases progressively as the emission sweeps or moves from one end to the other of the resistance. It is this sweeping action and changing of resistance that varies the frequencies in the tube circuit 64 from one million to one million, five thousand cycles one million times per second.

The tube circuit 62 controls the vertical deflector plates 30 and 31 so as to produce oscillation of the emissions at a frequency above the audible range, for example, at a frequency of twenty thousand per second. This tube circuit 62 is connected by a wire 71 to an amplifier 67 which in turn is connected to the resonant control circuits 72 to be described. These circuits 72 are coupled resonantly to the bar 66 and each circuit is controlled by a key 73 of the key manual 74. Preferably eighty-eight circuits are provided to produce a complete range of notes. Each circuit is balanced and coupled with the bar 66 so as to pick up the differential frequencies between the ends of the bar set up by the resonant actions of the tube circuit 63 and the tube circuit 64 with its associated reactance 60.

By the connection including wire 71, tube circuit 62 and the plates 30 and 31, the frequencies picked up off the bar 66 by the control circuits 72 are impressed on the frequency of the tube circuit 62 to produce resonant resultant frequencies within the audible range and of oscillating characteristics corresponding to the notes of the scale selected by the key manual. These resonant frequencies, impressed on the deflector plates 30 and 31 are utilized for causing the emissions to scan the pattern 40 to energize the reproducing means 42 and 43.

It is to be understood that the inaudible frequency impressed by the tube circuit 62 is maintained constantly and that the resonant audible frequency is superimposed so that the pattern and reactance are scanned at an inaduible and at an audible frequency, simultaneously.

Obviously, a two emission tube system can be used employing the principles of the single emission tube system shown in Fig. 3. In that event, the deflector plates 30 and 31 and the pattern 40 can be omitted, the emissions being oscillated by the tube circuit 63 to progressively vary the oscillating characteristics of the tube circuit 64 through the reactance 60. The pickup off of the resonant oscillating system 65 will be led off through wire 71 to deflector plate 31 like that shown in Fig. 1. In this embodiment the fixed frequency oscillator 38, the tube 20 and the reproducing means 42 and 43 will be the same as in Fig. 1.

In the embodiment shown in Fig. 4, a tube 89 having sets of deflector plates 30 and 31 and 32 and 33, a fixed frequency oscillator 38 (not shown), connected with plates 32 and 33, the pattern 40 and the reproducing means 42 and 43 (not shown) are the same as in Fig. 1. In Fig. 4, the emissions are used as a contacting means to cause their own vertical deflection for scanning the pattern at variable frequencies. Two series of magnets 80 and 81 are disposed on opposite sides (top and bottom) of the tube and in a position to deflect the emissions after they pass the plates 30 and 31. Plate 30 is connected by a wire 82 to magnets 80 and, similarly, the plate 31 is connected by wire 83 to magnets 81, i. e., each plate is connected to the magnets 80 and 81 disposed on the opposite side of the tube. Each magnet is connected in a control circuit controlled by a key 84 of a manual 85. These magnets function as electro-magnetic deflectors. Wire 86 connects the keys 84 through battery 88 with a cathode gun generally indicated at 90. This gun is arranged so that, with no external deflection force on the emissions, the emissions are biased to contact one or the other of the plates 30 or 31 when current is supplied to the tube 89. The battery 88 is merely added to give a more definite current value to the beam. Now if a key 84 is depressed, a circuit is set up from the gun 90 through wire 86, key 84, wire 92, magnet 81, wire 83, deflector plate 31, and through the emissions back to the gun 90. This causes energization of the magnet 81 which deflects the beam so that it touches the plate 30. When the emissions strike plate 30, a similar circuit is completed to energize a magnet 80. Thus when a key 84 is depressed, the emissions oscillate between the plates 30 and 31. The frequency of oscillation of the emissions is controlled by the reactance in the particular magnet circuit. Eighty-eight of these magnet circuits may be supplied and each reactance is tuned to a different desired frequency, so that all the notes of a piano can be reproduced. These oscillating emissions scan the pattern vertically and the fixed frequency oscillator 38, (not shown) connected to plates 32 and 33, produce the desired horizontal deflection at an inaudible frequency. Like in the other embodiments, the emissions are responsive to one or more frequencies concomitantly, so that a single note or chords can be produced.

Another form of oscillator is shown in Fig. 5. Here, again the emissions are used as a contact means to cause self-oscillation. The tube 89 is provided with a cathode gun 90 and deflector plates 32 and 33. The adjustment is such that during oscillation of the emissions, the emissions strike the contact plates 94 and 95 disposed at the end of the tube.

The circuits involved may be traced as follows: plate 95 is connected by a wire 98 to discharge device 96, which has a fixed discharge balance. The device 96 is in turn connected by wire 102, to the deflector plate 32. The contact plate 94 is in series circuit with wire 99, discharge device 97, wire 101, switch 106 and wire 103 to the deflector plate 33. A key as 105 is used to bridge the switch 106 and a source of potential, for example a battery 104 is in series with the key 105 and the cathode gun 90. The battery 104 is added to energize the circuit since it is apparent that the current value of the beam is very low.

The emissions are biased by adjustment of the gun 90 to normally strike the plate 95 since this last plate is in the path of the emissions. Thus a circuit will be completed, by means of the ray, between the cathode gun 90 and the contact plate 95. This circuit will build up energy in the device 96 to cause the connected deflector plate 32 to exert an attractive force on the emissions to draw the emissions to the plate 32. As soon as the aforementioned force is sufficient, the emissions travel from plate 33 to plate 32. This, of course, breaks the emission contact between gun 90 and plate 95, which causes a breakdown or discharge of device 96. This action is practically simultaneous. When the emissions strike the plates 94, a similar build-up occurs in device 97 to activate the deflector plate 33. The action on the return of

the emissions is similar to the foregoing explanation. This charging and discharging continues as long as the circuit is complete to cause an emission oscillation and an oscillating current output from the discharge devices 96 and 97. The rate of frequency of the oscillations is dominated by the reactance value of the discharge devices 96 and 97.

In a similar manner, eighty-seven additional balanced sets of discharge devices of different values may be connected in the circuit of the same contact plates 94 and 95 to give the desired frequency of oscillation to correspond with any musical note of the complete piano scale. In order to select the frequency or frequencies to be produced, a manual (not shown) is provided with keys 105. Each of the eighty-eight sets of discharge circuits is also provided with a switch 106 and 107 to normally maintain an open circuit. Thus, it will be noted that when key 105 is depressed, it bridges or closes the switch 106 to complete the discharge circuit.

The frequency of breakdown of the devices 96 and 97 is transmitted to a circuit as shown in Fig. 1, where a cathode ray tube 20 is used, which includes a pattern 40, to be scanned by the oscillating emissions, to activate the reproducing means 42 and 43. In this manner the tube 99 is being used as a variable frequency oscillator to replace the other modifications of variable frequency oscillators previously explained.

In all the embodiments described, the oscillator used, regardless of type, must have definite characteristics to produce satisfactory results. The usual wave form or pattern of oscillation describes a sine wave. This type of oscillation is not satisfactory when used in a sound producing system, since the rate of charge and discharge of the oscillator is variable which would cause tonal notes to be produced that are lacking in fidelity. To obtain the proper results, the wave form of the oscillator must trace a saw-tooth pattern. That is, the charging portion of each cycle of the wave must be linear and substantially free from a curve. This linear or straight line path indicates a constant increase of voltage in respect to time. The discharge from the maximum charge to zero should be perpendicular, indicating a practically instantaneous return to the starting point.

Adjustments to an oscillator circuit to obtain a saw tooth wave form are easily made and are well known to the art.

While the forms of embodiment of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. In a sound producing device, in combination, means for producing an electronic stream; deflector means for imparting oscillating movement to said stream; means capable of producing oscillations of different frequencies, excited by said oscillating stream; a character adapted to be excited by the stream; and means controlled by the third mentioned means for causing the stream to sweep the character.

2. A variable frequency oscillator comprising in combination means for producing an electronic stream; deflector means for imparting oscillating movement to said stream; and means, capable of producing oscillations of different frequencies concurrently, excited by said stream.

3. In a reproducing device, in combination, means for producing oscillations of different frequencies concurrently, means for producing electronic emissions, means associated with the first means and excited by said emissions for controlling the first means, a character adapted to be excited by said emissions, and means associated with the first means for causing emissions to sweep the character.

4. In a sound producing device, a variable frequency oscillator comprising in combination, means for producing oscillation of different frequencies concurrently, means for producing an electronic stream, deflector means for imparting oscillating movement to said stream, and means associated with the first means and excited by said stream for controlling said first means.

5. In a reproducing device, in combination, means for producing electronic emissions; a character adapted to be excited by said emissions; means for causing movement to be imparted to the emissions; oscillating means capable of producing oscillations of different frequencies concurrently, excitable by said moving emissions; a controller associated with the oscillating means for selecting the frequencies of such oscillations; and means responsive to the last named means for causing oscillation of the emissions and for causing said emissions to sweep the character.

6. In a sound producing device, in combination; means for producing electronic emissions; means for deflecting said emissions at a frequency above the audible range; means, capable of producing oscillations of different frequencies within the audible range, controlled by said deflecting emissions; a character adapted to be excited by electronic emissions; means for causing said emissions to sweep the character, and means for selectively impressing the said oscillations of different frequencies upon the character.

7. In a reproducing device, in combination, means for producing an electronic stream; means for causing an oscillatory movement to be imparted to the stream; variable frequency oscillating means; and means associated with the oscillating means and excitable by the moving stream for causing the oscillating means to produce a plurality of different electrical oscillating frequencies concomitantly.

8. In a reproducing device, in combination, means for producing electronic emissions; means for causing movement to be imparted to the emissions at a frequency above the audible range; variable frequency oscillating means; and means associated with the oscillating means and excitable by the moving emissions for causing the oscillating means to produce a plurality of different electrical oscillating frequencies within the audible range concomitantly.

9. A reproducing device comprising in combination, means for producing electronic emissions; a character adapted to be excited by the emissions; means for causing a sweeping movement to be imparted to the emissions; oscillating means; a key manual; means capable of excitation by said sweeping emissions and associated with said oscillating means and said key manual for causing the oscillating means to produce oscillating frequencies within the audible range and for selecting the frequency of such oscillation; and means responsive to the last named means for causing said emissions, oscillating within the audible range to sweep the character.

10. In a reproducing device, in combination, means for producing electronic emissions; a character adapted to be excited by emissions; oscillating means; means excitable by emissions

for concomitantly causing the oscillating means to produce a plurality of different electrical oscillating frequencies within the audible range; means for causing emissions to sweep the character at the audible range frequencies; and a controller associated with the last mentioned and the oscillating means for selecting the frequencies at which emissions sweep the character.

11. In a reproducing device, in combination, means for producing electronic emissions; a character adapted to be excited by emissions; oscillating means for deflecting emissions at a rate above the audible range; means excitable by said deflecting emissions for concomitantly causing a plurality of oscillating frequencies within the audible range; means for causing emissions to sweep the character at the audible range frequencies; and a controller associated with the last mentioned and the oscillating means for selecting the frequencies at which emissions sweep the character.

12. In a sound reproducing device, in combination, means for producing electronic emissions; a character adapted to be excited by the emissions; oscillating means; means for causing a sweep movement to be imparted to the emissions; means capable of excitation by said sweeping emissions for causing the oscillating means to produce oscillating frequencies within the audible range and for selectively controlling the frequency of such oscillation; and means controlled by the oscillating means for causing said emissions within the audible range to sweep the character.

13. A reproducing device comprising in combination a cathode ray tube; means excitable by the ray emission; oscillating means; means excitable by the ray emission for concomitantly causing the oscillating means to produce a plurality of different electrical oscillating frequencies within the audible range; means for causing the emissions of the tube to sweep the first means at the audible range frequencies; and a key manual associated with the last named and the oscillating means for selecting the frequencies at which the emissions sweep the first named means.

14. A reproducing device comprising in combination a cathode ray tube; means excitable by the ray emission; oscillating means for deflecting the emission at a rate above the audible range; means excitable by the movable emission for concomitantly causing a plurality of oscillating frequencies within the audible range; means for causing the emissions of the tube to sweep the first means; and a key manual associated with the last named and said excitable means for selecting the frequencies at which the emission sweeps the first named means.

15. A variable frequency oscillator comprising in combination, an oscillator tuned to normally operate at a constant frequency; and means connected with the oscillator and cyclically operable for progressively changing the speed of oscillations of the oscillator including an electrical reactance, means for producing an electronic stream and means for causing the electronic stream to cyclically sweep the reactance.

16. In a variable frequency oscillator, means for producing electronic emissions, resonant means responsive to current oscillations, means for imparting constant rate oscillations to said emissions and to said resonant means, an electrical reactance excited by oscillations of said emissions, and another means for imparting oscillations and connected with the resonant means and the electrical reactance.

17. That step in the method of producing oscillation of different frequencies which comprises producing an electronic stream, periodically deflecting the path of movement of such stream and exciting electrical reactance periodically by the deflecting stream.

18. That step in the method of producing variable oscillations and sounds which comprises producing electronic emissions; periodically deflecting such emissions; exciting electrical reactance periodically by the deflecting emissions; causing an oscillator, capable of producing variable frequencies to respond to the excitation of the reactance; causing electronic emission to sweep a character; and controlling the frequency of sweeping, of the means through the oscillator.

19. The method of producing a range of oscillating frequencies concurrently which comprises producing electronic emissions; causing oscillation of such emissions at a constant rate; causing the moving emissions to periodically energize a plurality of contacts; energizing a plurality of circuits which are connected to an oscillator and to the contacts and which circuits have different frequency results concurrently on the oscillator; and selectively controlling the energization of the circuits whereby the oscillator is tuned by the emissions to produce a plurality of frequencies concurrently in accordance with the circuits energized.

20. In an oscillating system, an oscillator, means for producing electronic emissions, means for oscillating the emissions, a plurality of contacts capable of excitation by the emissions and disposed in the path of the oscillating emissions so as to be periodically excited thereby, a plurality of control circuits connected to the contacts and the oscillator, each of said circuits having a different frequency result on the oscillator, and means for controlling said circuits whereby the oscillator is tuned by the emission to produce a range of frequencies in accordance with the circuit energized.

21. The method of producing electrical impulses which comprises causing electronic emissions to sweep a character, which is excitable by the electronic emissions; causing the sweeping emissions to contact a plurality of contacts; causing a plurality of circuits capable of producing different frequencies to be energized when emissions contact with the contacts; selectively controlling the energization of the circuits; and causing the energized circuit or circuits to control the frequency of the sweep of the emission.

22. The method of producing a range of oscillating frequencies which comprises, producing electronic emissions; causing electronic emission to contact a plurality of contacts progressively; causing a plurality of circuits, capable of producing different frequencies, to be energized when emissions contacts with the contacts to oscillate the emissions; and selectively controlling the energization of the circuit or circuits to obtain one or more resultant frequencies.

23. In a variable frequency oscillator, means for producing electronic emissions, resonant means responsive to current oscillations, means for imparting constant rate oscillations to said emissions and to said resonant means, an electrical reactance, said reactance being excited by the emissions oscillating at a constant rate and adapted to impress variable frequency impulses during said oscillation of the emissions, another

means for imparting oscillations and associated with the resonant means and the electrical reactance so that said resonant means is subjected also to the variable frequency impulses impressed by the reactance, and a plurality of pick-ups, each resonant to a different frequency, said pick-ups being disposed to respond to frequencies established in said resonant means by the conjoint action of both of said oscillation imparting means.

24. In a variable frequency oscillator, means for producing electronic emissions, resonant means responsive to current oscillations, means for imparting constant rate oscillations to said emissions and to said resonant means, an electrical reactance, said reactance being excited by the emissions oscillating at a constant rate and adapted to impress variable frequency impulses during said oscillation of the emissions, another means for imparting oscillations and associated with the resonant means and the electrical reactance so that said resonant means is subjected also to the variable frequency impulses impressed by the reactance; a plurality of pick-ups each resonant to a different frequency, said pick-ups being disposed to respond to the frequencies established in said resonant means by the conjoint action of both of said oscillation imparting means; character means excited by said emissions, means for causing the emissions to sweep the character means, and means for selectively connecting the pick-ups with the sweep-controlling means.

25. That step in the method of producing different frequencies of oscillation concurrently which comprises producing an electronic stream; deflecting the path of movement of said stream; and energizing, by the deflecting stream, mechanism capable of producing different frequencies of oscillation concurrently when so energized.

26. That step in the method of producing different frequencies of oscillation concurrently to produce sound which comprises producing electronic emissions; deflecting such emissions; energizing, by the deflecting emissions, mechanism capable of producing different frequencies of oscillation concurrently when so energized; causing the emissions to energize means which, when energized by the emissions produces sound; and selectively varying the frequencies of energization of the means by selectively controlling the application of the frequencies, produced by the mechanism, to the emission which energizes the means.

27. That step in the method of producing different frequencies of oscillation concurrently which comprises producing an electronic stream; deflecting the path of movement of the stream at a constant frequency; and energizing, by the deflecting stream, mechanism capable of producing different frequencies of oscillation concurrently when so energized.

28. That step in the method of producing sound which comprises producing electronic emissions; deflecting such emissions at a constant frequency; energizing, by deflecting emissions, mechanism capable of producing different frequencies within the audible range; causing emissions to sweep a character; and controlling the frequency of sweeping of the character by the mechanism.

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