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3,235,648

SEMI-AUTOMATIC ELECTRONIC RHYTHM INSTRUMENT

Filed May 7, 1962

2 Sheets-Sheet 1

Fig. 1

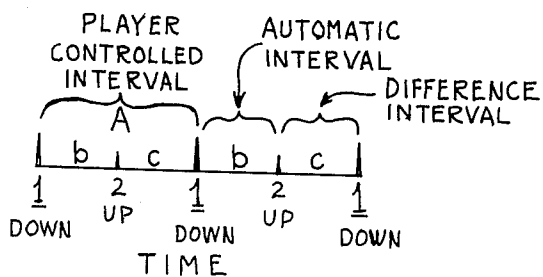


Fig. 2

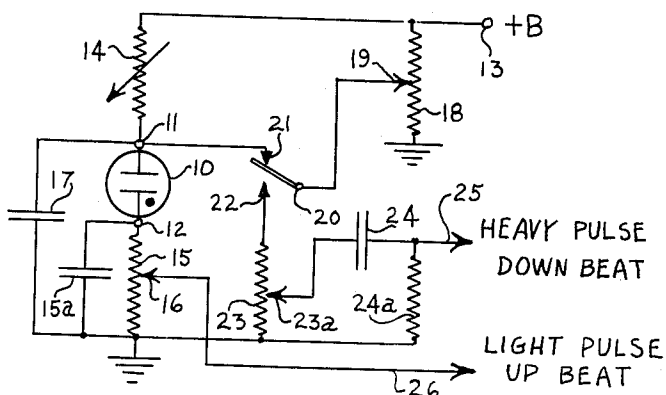


Fig. 3

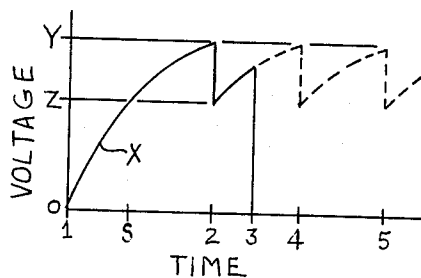
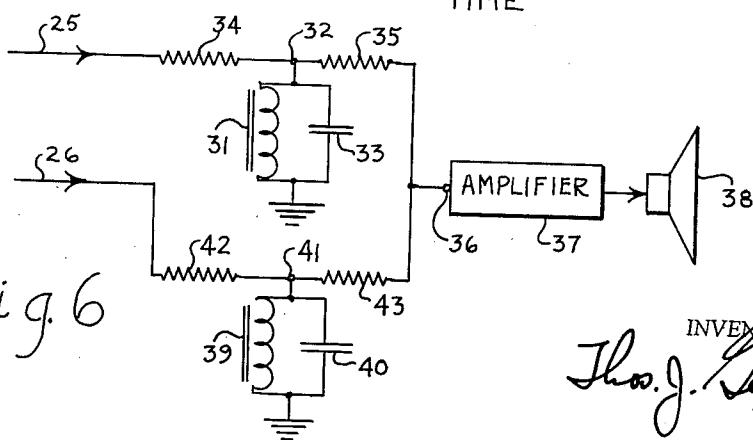


Fig. 6



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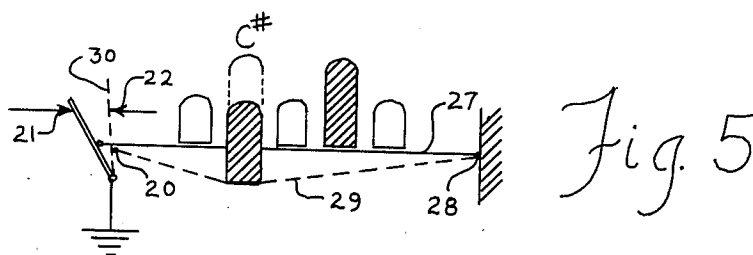
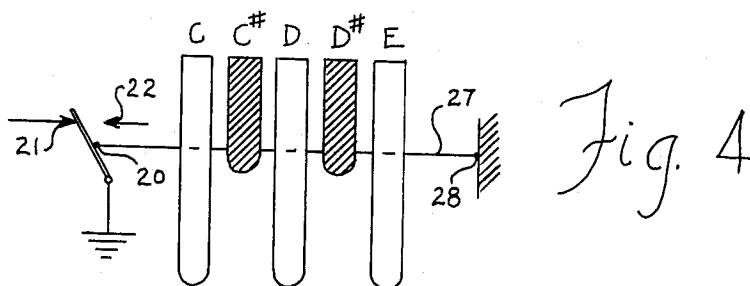
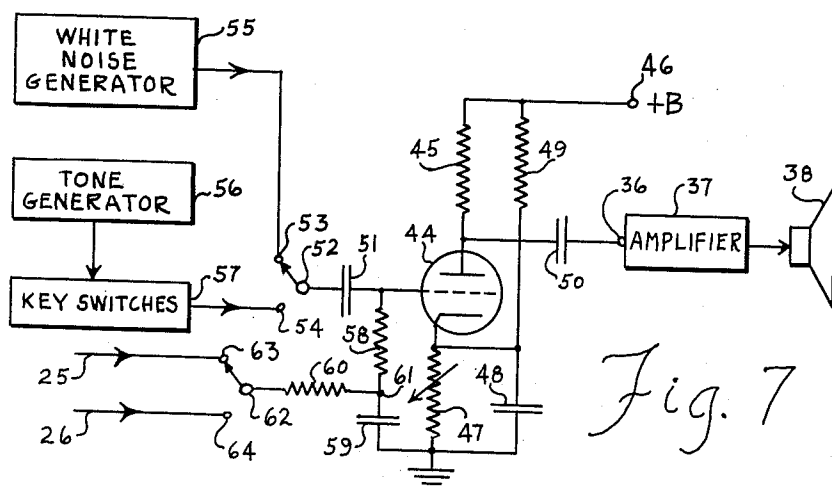
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2 Sheets-Sheet 2



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SEMI-AUTOMATIC ELECTRONIC RHYTHM INSTRUMENT

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This invention relates in general to musical instruments and more particularly to electronic means for producing rhythm effects.

Electronic musical instruments of the prior art have in general been developed more along the lines of instruments for producing organ tones rather than orchestral effects. The electronic organ however, has come to occupy a more and more important position in the field of entertainment, and in particular for the playing of popular music and dance music, which in the past has usually been provided by dance orchestras.

For this purpose it is customary when playing dance music on the organ, to establish the accented rhythm beat, or so called Down beat, by playing a heavy rhythmical accompaniment on the bass pedal keys of the instrument. While this helps greatly to establish the rhythm, still it is not as incisive as the various rhythm effects of the dance orchestra, as for example the drums, cymbals, woodblocks, guitar, and plucked string bass. Such rhythm instruments usually produce very percussive sounds which decay rapidly. This normally leaves brief periods of silence between successive beats of the percussive sounds. The alternating periods of silence and percussive sounds make the rhythm much more incisive than the consecutive playing of organ bass pedal notes, which may often be played legato or even in some cases with a sustain effect, which tends to "fill" the required periods of silence.

Sometimes the organ is played with accompaniment on actual percussive instruments, and while the effect is very good, additional players are of course required. It is highly desirable therefore to provide some simple means whereby the player can provide these rhythmical effects when playing the organ alone and in the normal manner.

Electronic rhythm devices of the prior art have provided some of these effects under limited conditions, when employed with electronic organs. These devices have operated automatically, much in the manner of a metronome, and while the rhythm sounds produced from them were quite useful, they suffered from certain limitations. The first of these was that the devices could not be turned on or off at the exact instant necessary to synchronize with the rhythm of the player. It was necessary for the player to start the rhythm device, and then attempt as quickly as possible, to synchronize his playing with the automatic beat of the device. At the end of the musical selection it was likewise impossible to stop the rhythm device in synchronism with the last beat of the music.

The second limitation lay in the fact that the devices produced a rhythm with absolute mechanical regularity, regardless of how the performer might be playing. It is very difficult for an average player to maintain the tempo of his playing with such mechanical regularity, and even an experienced player may have some difficulty playing in exact rhythm with such a mechanical device. The result is that the player finds himself either hurrying ahead or falling behind the rhythm beat, which of course completely spoils the musical effect desired.

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It is therefore a principal object of this invention to provide a rhythm device having simplified means to start and stop the rhythm effects in exact tempo with the music being played on the associated musical instrument.

It is another object to provide an automatic electronic time delay mechanism which generates a delayed rhythm beat, and which is initiated by the player of a musical instrument when using normal playing techniques.

It is another object to provide a rhythm device which is controlled and actuated by means of the bass pedal keys of the organ or other musical instrument with which it is employed.

It is another object to provide simplified means for causing the rhythm effects to always be in tempo with the rhythm of the music being played, and without requiring any new playing technique.

Another object is to provide an automatically controlled gate circuit for generating the musical effects of cymbal, plucked string bass and guitar strumming.

Another object is to provide simplified means for operating a control switch by any key of a bass pedal keyboard.

It is another object to provide simplified adjustable means for generating semiautomatic dance rhythms of both simple and more complex variety.

Other objects will appear from the following description, reference being made to the accompanying drawings in which:

FIGURE 1 is a graphic representation of two rhythm beats of fox trot dance tempo.

FIGURE 2 is a circuit diagram of an electronic discharge device for generating rhythm pulses in accordance with the invention.

FIGURE 3 is a graph of voltage changes occurring in the circuit of FIGURE 2, when plotted against time.

FIGURE 4 is a top view of a bass pedal keyboard and associated control switch.

FIGURE 5 is a front end view of the pedal keyboard and switch which are shown in FIGURE 4.

FIGURE 6 is a circuit diagram of formant circuits used in conjunction with FIGURE 2 in carrying out the invention.

FIGURE 7 is a circuit diagram of an electronic gate circuit employed in one embodiment of the invention.

In playing rhythmical music on the organ it is customary to establish the accented beat by means of the bass accompaniment which is played with the feet on the bass pedal keyboard. Excepting for musical embellishments which may occur, this rhythmical beat is continued throughout the selection being played. In a preferred form of the present invention this rhythmical action of the pedalboard, which is under complete control of the player, is used to initiate and control various automatically time delayed rhythm effects which are generated by means of the circuits disclosed herein and transmitted through the audio output system. These rhythm effects are heard along with the bass tones normally heard when playing the bass key pedals.

The principles involved may be generally described as follows. Upon the actuation of any pedal key of the bass pedalboard by the player's foot, a control means is operated which initiates a delayed sequence of automatically generated pulses which in turn generate percussive sounds of various selected characteristics. Upon the release of the pedal key the control means is restored, and the pulses and percussive sounds cease instantly. When next a

pedal key is actuated, the cycle is repeated, and ceases again upon the release of the pedal key. Thus in normal playing of the pedalboard, a rhythmical sequence of percussive sounds is provided which is always initiated in exact tempo or synchronism with the playing of the bass pedals. This is true because the accented beat is established by the player in the normal playing of the bass pedals, while the sequence of automatic percussive effects is initiated by the playing of each successive bass pedal.

Thus it is apparent that the first and the last beats of the rhythm device can be in perfect tempo with the first and last beats of the musical selection being played. Furthermore it is possible to introduce musical embellishments usually called "breaks," when for an interval of one or more beats the bass pedals are not played, and consequently there is no percussive accompaniment. When the rhythm is again resumed following the "break," the rhythm beat is in exact synchronism with the musical beat as controlled by the player. It should be noted that these effects are obtained with normal rhythmical playing of the pedalboard, no special playing techniques of any kind being required.

There are many different kinds of musical rhythms in common usage, from the well known waltz and fox trot to the more complex Latin and Spanish rhythms. All these rhythms are created by producing various percussive sounds, and spacing them at selected intervals in time. Also they all have a recurring characteristic or rhythm pattern, and this pattern is usually established by the same recurring sequence of percussive sounds. The simplest patterns are probably the fox trot and waltz, and only those will be discussed, since the same principles are used in building up the more complex rhythm patterns.

In fox trot tempo the time interval between consecutive accented beats, or so called Down beats, is divided into two equal parts by one additional, and unaccented, Up beat. This may be represented by counting slowly; as, ONE two, ONE two, etc. The ONE beats are the accented Down beats, and the "two" beats are the recurring pattern of unaccented Up beats, which identify the fox trot tempo. This is illustrated in FIGURE 1 where two whole fox trot beats are represented. The beats are represented as vertical marks, and time is shown as moving from left to right. As indicated, the time interval A, between consecutive ONE beats, or Down beats is controlled by the player, and this is accomplished by the normal rhythmical playing of the bass pedal keys. The interval b, which is the time elapsed between the Down beat and the Up beat, is controlled automatically by means disclosed herein. The interval c, which is the time elapsed from the Up beat to the next Down beat is a difference interval which is controlled by the player, and it is this interval where the flexibility in the use of the invention lies.

After any b interval is completed, with the automatic sounding of the Up beat, the c interval begins, and since the next Down beat must be initiated by the player, he is free to play the next pedal key and corresponding Down beat any time within the c interval, or even after that interval, if he may so desire. Thus the player may stretch or compress the c interval, but the Down beat will always be in synchronism with the pedal accompaniment. He may thus speed up or slow down the overall tempo of the musical selection within limits, but for best musical effect, he will of course attempt to make the c interval approximately equal to the b interval, when he is playing fox trot tempo. Rhythms other than fox trot may be played by the experienced player where the c interval is intentionally shortened or lengthened, but it will be understood that each pedal key which is played must be held operated at least until the completion of the automatically timed b interval.

FIGURE 2 illustrates a preferred form of automatic

timing circuit which may be used in carrying out the invention. An electron discharge device 10 which may be a neon lamp, is used in a modified relaxation oscillator circuit to generate percussive voltage pulses, the time spacings of which are readily varied and controlled. The lamp 10 has two terminals 11 and 12. Terminal 11 is connected to a source of supply voltage 13 by means of adjustable timing resistor 14, which may have a maximum resistance of 5 megohms. Voltage supply 13 may be approximately 150 volts D.C. Terminal 12 of the lamp is connected to ground through resistor 15, which has an adjustable tap 16. A capacitor 15a is connected in parallel with resistor 15. A timing capacitor 17 is connected from terminal 11 to ground. A potentiometer 18 is connected between voltage supply terminal 13 and ground. This potentiometer has an adjustable tap 19 which is connected to switch 20. This switch has a normally closed contact 21 which is connected to terminal 11 of the neon lamp. Switch 20 has a normally open contact 22, and resistor 23 is connected between this contact and ground. Resistor 23 has an adjustable tap 23a. Blocking capacitor 24 interconnects tap 23a and output lead 25. Resistor 24a interconnects output lead 25 and ground. Output lead 26 is connected to the adjustable tap 16 of potentiometer 18.

In explaining the operation of the circuit assume that tap 19 of potentiometer 18 is set to the ground end of the potentiometer. As long as the switch 20 remains non operated as shown, terminal 11 is grounded, which short circuits capacitor 17. This holds the capacitor in a completely discharged condition, and the full supply voltage appears across resistor 14. When switch 20 is operated the short circuit is removed and the capacitor begins to charge, through resistor 14, from the B plus supply 13. After a time interval which is determined by the values of resistor 14 and capacitor 17, the voltage at terminal 11 reaches the breakdown voltage of the neon lamp. The lamp ignites, quickly discharging capacitor 17 until the extinction voltage of the lamp is reached. This is illustrated in FIGURE 3 which is a curve of voltage conditions across capacitor 17, plotted against time. Voltage is represented vertically and time horizontally.

The opening of the switch is indicated as point 1 on the time axis. The voltage starts from zero at point 1, and rises with time along curve x. When, at time 2, the voltage across capacitor 17 reaches voltage Y, the ignition voltage of the neon lamp, the lamp fires. This partially discharges the capacitor, quickly bringing the voltage down to voltage Z, the extinction voltage of the lamp. Since resistor 15 is in series with the capacitor and the neon lamp, a momentary pulse of voltage appears across the resistor. When the lamp is extinguished at point 2, the voltage begins to rise as before, starting from voltage Z instead of from zero. If at some point 3 the switch is restored to its non operated position, the capacitor is short circuited and the voltage drops immediately to zero, restoring the circuit to its former condition in preparation for a reoperation of the control switch. If however the switch is held operated beyond point 3, the voltage continues to rise along the curve indicated by the dashed line, until once more it reaches voltage Y, when again a partial discharge occurs at point 4, and the voltage again begins to rise toward point 5. This recurring cycle of events is the action of the well known relaxation oscillator and it will continue as long as the control switch is held operated.

It is apparent that the time interval from point 2 to 4 is equal to the interval from 4 to 5, but that the time interval from 1 to 2 is greater than either. This is due to the fact that the voltage must rise from zero when starting from point 1, and will of course take longer. If however, curve x is made to start from voltage Z instead of from zero, then the first interval will be equal to all succeeding intervals, and this adjustment may be

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reached by setting tap 19 of potentiometer 18 to voltage Z. With this adjustment curve *x* will start from point S instead of point 1. It is thus apparent that the first interval may be adjusted to any length between points 1 and 2, by setting the voltage point of tap 19 to the desired position, and if it is set for example, to just below voltage Y, the lamp will fire almost immediately upon operation of the switch.

Now assuming that tap 19 is set to voltage Z, two actions will take place when switch 20 is operated. The first is that capacitor 17 begins to charge as just described. The second is that switch 20 makes contact with normally open contact 22 and transmits voltage from tap 19 to resistor 23. Depending upon the position of tap 23a, a positive voltage pulse of selected magnitude is transmitted through blocking capacitor 24, and over output lead 25 to other circuits. The charge thus placed upon capacitor 24 is then dissipated at a rate depending upon the values of capacitor 24 and resistor 24a. At a later time the delayed voltage pulse across resistor 15 appears. By means of output lead 26, connected to tap 16, this delayed voltage pulse may be carried to other circuits, and the magnitude of the pulse may be adjusted by means of the tap. Thus when switch 20 is operated, there is an immediate first pulse over output lead 25, and a delayed pulse or series of pulses over output lead 26. If by appropriate interconnecting circuit means these pulses are used to drive an amplifier and speaker, the operation of the switch will cause a series of percussive sounds, rhythmically spaced in time, which will cease upon restoring the control switch.

Referring now to FIGURE 1 in conjunction with FIGURES 2 and 3, assume that by means of tap 19 the first interval has been set to start at some time between points 1 and 2 of FIGURE 3, for example point S. The first operation of the switch, which is point S, may be identified with the first Down beat of FIGURE 1. The interval from S to point 2 of FIGURE 3 is identified with the interval *b* of FIGURE 1, and point 2 in each figure is the first Up beat. Sometime after point 2 in each figure, the switch is restored, and at the next Down beat the switch is again operated, which starts the timing sequence again at point S. Thus the rhythmical operation of the switch will produce synchronized Down beats, followed by automatically timed Up beats. Normally the Down beat will be of greater intensity than the Up beat. The relative intensity may be adjusted by means of tap 23a of potentiometer 23, which controls the Down beat pulse intensity, and tap 16 of potentiometer 15, which controls the Up beat pulse intensity.

As earlier suggested the control switch 20 is actuated by the playing of any pedal key, and to establish the proper setting for tap 19, it is only necessary to establish the tempo desired, by playing the pedal keys, and then adjust tap 19 until the Up beats come approximately midway between consecutive Down beats. This is easily judged by ear, and as mentioned earlier, considerable leeway is permissible. It is thus apparent that the rhythm device of the present disclosure follows the player. This is in marked contrast to rhythm devices of the prior art wherein the player must follow the rhythm device.

The foregoing description applies to fox trot tempo. To play waltz tempo, it is only necessary after setting tap 19 to voltage Z, to hold the bass pedal key operated following each Down beat, for two automatic Up beats, instead of one as in fox trot tempo. The time spacing between consecutive beats is easily changed by adjusting the resistance value of variable resistor 14. Thus to increase the tempo, this resistor is reduced in value, and to decrease tempo it is increased. Therefore if tap 19 is set to voltage Z, then variable resistor 14 serves as a convenient control for changing tempo, whether fox trot or waltz tempos are being played. The recurring rhythm pattern in fox trot tempo has one Up beat, and in waltz tempo it has two equally spaced Up beats. In other

more complex tempos it will have other numbers, and other spacings of Up beats, and it will be apparent that if two or more of the circuits of FIGURE 2 are used, to provide different spacing of time intervals, very complex rhythm patterns may be obtained.

As suggested, the control switch 20 may be arranged to be operated by any note which is played on the bass pedal keyboard. FIGURES 4 and 5 illustrate one method for doing this. FIGURE 4 shows a top view of five keys of a pedal keyboard, notes C through E. The number of keys used is not significant, so long as there are more than one. A flexible member 27, such as a light wire cable or dial cord, is shown stretched beneath the pedal keys in such position that any key will bear against the cord when operated. The cord is shown connected to a solid support means 28 at one end, and to the switch arm 20 at the other end. Switch 20 is shown in solid lines in the restored position in both figures. FIGURE 5 is a front end view of the pedal keys and shows that the cord 27 in its normal position is suspended beneath the keys so that it is almost touching them. The C# pedal key is shown in an operated position, and the position of the dashed line 29 indicates how the cord 27 is displaced when a pedal key is operated. This tends to shorten cord 27 which results in moving switch 20 into the operated position. This is shown by the dashed line switch arm 30, which is making contact with normally open contact 22. Various other means, either mechanical or electrical can be devised to provide the same result, instead of the flexible cord arrangement illustrated.

The rhythmic voltage pulses generated by the timing circuit of FIGURE 2 can be used in a number of ways to generate or control, a variety of percussive sounds, including the effects of wood blocks, cymbals, drums, guitar, and string bass.

The simplest circuits for obtaining colorful percussive effects are comprised of formant circuits alone. This method is illustrated in FIGURE 6, which is to be taken in conjunction with FIGURE 2. Two parallel tuned circuits are shown. An indicator 31 is connected between terminal 32 and ground, and a capacitor 33 is connected in parallel therewith. An isolating resistor 34 interconnects terminal 32 and output lead 25 of FIGURE 2. Another isolating resistor 35 interconnects terminal 32 and input terminal 36 of amplifier 37. This amplifier drives speaker 38. A second inductor 39 and parallel connected capacitor 40, interconnect terminal 41 and ground. An isolating resistor 42 interconnects terminal 41 and output lead 26 of FIGURE 2. Another isolating resistor 43 interconnects terminal 41 and amplifier input terminal 36. Inductor 31 and capacitor 33 may be tuned to a frequency between 30 and 100 cycles. Inductor 39 and capacitor 40 may be tuned to a frequency between 400 and 1000 cycles. The heavy Down beat pulses transmitted over lead 25 will shock excite the tuned circuit connected to terminal 32 at its resonant frequency. The frequency will die away quickly, and an effect resembling a drum will be heard from the speaker. The lighter Up beat pulses transmitted over lead 26 will shock excite the tuned circuit connected to terminal 41. The frequency will quickly die away and a sound resembling a struck wood block will be heard from the speaker. Thus a drum sound will be heard on the Down beat, and a wood block sound on the Up beat. The four isolating resistors should have values which are large, relative to the impedance of the tuned circuits, in order to avoid degrading the Q of the tuned circuits.

Percussive sounds other than those which can be obtained by shock exciting tuned circuits can also be obtained. FIGURE 7 illustrates one way in which a gate circuit can be controlled by the voltage pulses from the timing circuit of FIGURE 2 to provide some of these effects. A triode tube 44 is arranged as an amplifier having a plate load resistor 45 interconnecting the plate of

the tube and voltage supply 46, which may be approximately 150 volts D.C. An adjustable cathode resistor 47 interconnects the cathode of the tube to ground. This resistor is bypassed to ground by capacitor 48. A biasing resistor 49 interconnects the cathode of the tube and the B plus supply 46. A plate blocking capacitor 50 interconnects the plate of the tube and the amplifier input terminal 36. A blocking capacitor 51 interconnects the grid of the triode and a selector switch 52. This switch is used to select the input signal to the gate tube, and it has two switch points 53 and 54. A white noise signal generator 55 is connected to point 53. A tone signal generator 56 and its associated keyboard switches 57 is connected to switch point 54. The tone generator may be either a polyphonic generator or a solo tone generator, and if it is to generate the bass notes of the instrument, then the key switches 57 may be arranged to be operated by the pedalboard keys of the instrument, such as those shown in FIGURES 4 and 5. A grid resistor 58 and a capacitor 59 are serially connected between the grid of the tube 44 and ground. A resistor 60 interconnects their junction point 61 and selector switch 62. This switch has two switch points 63 and 64. Point 63 is connected to output lead 25 from the timing circuit of FIGURE 2. Point 64 is connected to lead 26 from FIGURE 2.

The signal level of the two signal sources 55 and 56 which appear at switch points 53 and 54, should be adjusted to a low voltage such as approximately one to five volts. The cathode bias resistor 47 should be adjusted to that value where the tube is just cut off when switch 52 is set to either switch point. Under these conditions no signal will be transmitted from the plate of the tube to amplifier 37. In describing the operation of the circuit, assume that switch 52 is set to point 53, and switch 62 is set to point 63. When any pedal key is played, which operates switch 20 of FIGURE 2, a positive voltage pulse is immediately transmitted over lead 25, through switch 62 to control terminal 61 and thence to the grid of the triode. The bias on the grid is moved into the operating region, and the tube transmits a brief pulse of noise signal to amplifier 37 and the speaker. The positive pulse decays to zero causing the tube to return to cut off, and the pulse of noise from the speaker dies away percussively, and produces the effect of a struck cymbal. For best cymbal effect the noise generator 55 should produce strong signals in the high frequency range above several thousand cycles. As long as selector switch 62 is set to point 63 the cymbal effect will occur on the Down beat of the rhythm, but if it is set to point 64 the effect will occur on the Up beat. If selector switch 52 is set to point 54 and one or more of the key switches 57 are played when the pedal switch 20 is operated, a percussive musical sound will be heard from the speaker, either on the Down beat or the Up beat, depending upon the position of selector switch 62. This sound will resemble a plucked string bass if a single bass note is played. If several notes in the higher range, near middle C for example, are played, the percussive effect will suggest the strumming of a guitar if the correct tone color is used.

The usual touch used in playing the organ is employed and the rhythmic strumming will continue as long as the keys are held, and as long as the pedal keys are simultaneously played in rhythmic manner as described earlier. Furthermore the strumming will be in exact rhythm with the music, which is superior to some of the instruments of the prior art in which the percussive strumming is obtained automatically and at random. Also the strumming will cease at the end of the musical selection, or at any other time desired by the player, by merely ceasing to play the bass pedal keys, and without touching any manually operated controls.

When the gas discharge device 10 is a type NE 2 and the triode 44 is a type 12AU7, the following component

values are suitable for the circuits shown in FIGURES 2, 6, and 7.

14—5 megohms	40—.02 mfd.
15—100K ohms	42—220K ohms
15a—.1 mfd.	43—220K ohms
17—.1 mfd.	45—220K ohms
18—100K ohms	47—100K ohms
23—50K ohms	48—.05 mfd.
24—.1 mfd.	49—220K ohms
24a—1 megohm	50—.02 mfd.
31—50 henries	51—.005 mfd.
33—.25 mfd.	58—1 megohm
34—220K ohms	59—.05 mfd.
35—220K ohms	60—330K ohms
39—5 henries	

The triode 44 may of course be replaced by a transistor or a multi-element vacuum tube, without departing from the principle of the invention. It will be apparent that by employing two or more timing circuits, with two or more gate circuits having input signals from different signal generators, very complex and very entertaining rhythm effects may be obtained, and with no additional effort or any different playing technique, on the part of the player.

It will be apparent to those skilled in the art that the neon tube and delay circuit can be replaced by a thyatron relaxation oscillator. Also, a multivibrator, a ring counter, or a blocking oscillator, using either transistors or vacuum tubes, could be used to obtain similar automatic delay action and that other gate devices may be employed to obtain similar gate action.

When properly adjusted and played with an electronic musical instrument having good solo tones, the rhythm effects of this invention are very suggestive of the sounds of a dance orchestra. Also the piano may be accompanied with excellent effect, by means of the rhythm devices disclosed herein. The piano is preferably equipped with a bass pedal-board, and most piano-organ combinations currently manufactured, are so equipped. However, if it is not, then the rhythm device can be operated by means of the piano sustaining pedal, since in rhythm playing it is customary to operate this pedal in rhythm with the tempo of the music.

In summary, the features of novelty in this disclosure, and which are described in the appended claims, are:

(1) Pedal controlled means for generating an automatically delayed rhythm beat.

(2) Simple and adjustable means for controlling the amount of delay.

(3) Pedal controlled means for starting and stopping an automatic rhythm generator exactly in tempo with the music being played.

(4) Simple automatic timing means for generating a rhythm beat.

(5) Player controlled means for generating a delayed tone beat or delayed noise beat.

(6) Player controlled means for providing delayed operation of a gate device.

(7) Flexible elongate member used with pedalboard to operate a control switch.

(8) Playing key controlled means in a polyphonic keyboard instrument, for generating automatic rhythm chords on Down beat or on Up beat.

Although certain preferred embodiments of the invention have been described and illustrated, it will be apparent to those skilled in the art that variations of the structures and circuits shown can be made without departing from the broader aspects of the disclosed invention. As an example, instead of employing a flexible elongate member for operating the control switch 20, a rigid elongate member hinged at both ends, and coupled to the switch, could be employed for the same purpose. I therefore desire by the appended claims to include within the scope of the invention all such similar and

modified forms of the circuits and apparatus disclosed herein, by which substantially the results of the invention may be obtained, using substantially the same or equivalent means.

What is claimed is:

1. In an electronic rhythm instrument having foot operated means for establishing the accented beat and automatic means for generating the unaccented beat, a normally inactive voltage pulse generating circuit comprising an electron discharge device, a voltage supply source, a switch, circuit means including said switch interconnecting said discharge device and said supply source, time delay means including a capacitor and a resistor serially connected between two terminals of said source, said time delay means coupled to said discharge device and to said switch, means controlled by said foot operated means for actuating said switch for rendering said pulse generating circuit active to generate a first pulse and a delayed pulse.

2. In an electronic rhythm instrument, an amplifier and speaker, a foot operated pedal, a control switch adapted to be operated by said pedal, a normally quiescent pulse circuit including an electron discharge device for generating delayed electrical rhythm pulses, a source of supply voltage coupled to said discharge device to energize said device, time delay means comprising resistance and capacitance coupled to said discharge device and to said source, control circuit means for starting said pulse circuit including said switch and coupled to said time delay means, said control circuit interconnecting said voltage source and said pulse circuit, circuit means including a formant circuit interconnecting said pulse circuit and said amplifier for transmitting to said speaker at least one delayed rhythm pulse upon the operation of said pedal.

3. In an electronic rhythm instrument having a pedal keyboard and a control switch adapted to be operated by any key of said keyboard, means for generating rhythmic voltage pulses comprising a low frequency relaxation oscillator, said oscillator being normally in a quiescent state, a voltage source having three terminals coupled to said oscillator, time delay means connected to said oscillator comprising a capacitor and an adjustable resistor serially connected between two of said terminals, circuit means interconnecting said oscillator and said third terminal and including said switch for holding said oscillator quiescent when said switch is nonoperated and for starting said oscillator upon the operation of any key of said keyboard.

4. In an electronic musical instrument having a foot operated pedal, a manual keyboard, and a tone generator which is controllable from said manual keyboard, a gate circuit comprising a unilaterally conductive device having an input terminal, an output terminal, and a control terminal, a voltage source, resistive circuit means coupling said source to said conductive device to maintain said device normally in a nonconductive condition, circuit means coupled to said input terminal and for receiving signals from said tone generator upon the operation of any manual key, a control switch operable by said pedal, a delayed voltage pulse generating circuit under control of said switch, circuit means including said switch and said pulse circuit interconnecting said source and said gate control terminal for transmitting a delayed voltage pulse to said control terminal to open said gate briefly upon the operation of said pedal, an output system, circuit means coupling said gate output terminal to said output system to transmit a brief delayed pulse of tone signal to said output system upon the concurrent operation of any manual key and said pedal.

5. In an electronic rhythm instrument for generating automatically timed voltage pulses and having a foot operated pedal for establishing the accented beat, switching means adapted to be controlled by said pedal, a gen-

erator of timed voltage pulses comprising an electron conductive device coupled to a capacitance-resistance timing circuit, a voltage source, a circuit including said switching means interconnecting said source and said generator for rendering said generator inactive when said switching means is nonoperated, and active when said switching means is operated to generate automatic rhythm pulses, and selective circuit means intercoupling said generator and said source to select the time interval between the operation of said pedal and the first voltage pulse.

6. In an electronic instrument for providing a delayed rhythm pulse a bass pedal keyboard having a plurality of keys arranged in a horizontal position, a switching means, a flexible elongate member supported in such relation to said keys that any key when operated will bear against and tend to stretch said member, said member being mechanically coupled to and operable by said switching means, a delayed pulse generating means including an electronic conductive device coupled to adjustable delay means comprising a capacitor and an adjustable resistor, circuit means coupling said delayed pulse generator to said switching means to render said generator inactive when said switching means is nonoperated and active when operated to generate a delayed rhythm pulse.

7. In an electronic rhythm instrument, a normally quiescent electronic timing device for generating a first voltage pulse and a delayed voltage pulse comprising, a delay circuit comprising a source of supply voltage having two terminals, an electronic discharge device serially connected with a first resistor and a second resistor between the terminals of said voltage source, said first resistor being substantially larger in value than said second resistor, said first resistor being adjustable, a capacitor coupled to said electronic discharge device, a third resistor interconnecting the terminals of said voltage source, said third resistor having an adjustable tap, a switch for starting said timing device, circuit means including said switch interconnecting said tap and one terminal of said capacitor, a first pulse output terminal connected to said switch, a second pulse output terminal connected to said second resistor, an audio output system, circuit means interconnecting said first output terminal and said output system, circuit means interconnecting said second output terminal and said output system, means for operating said switch to transmit a first voltage pulse and a delayed voltage pulse to said audio system.

8. In an electronic rhythm instrument for generating automatically timed percussive noise sounds and having a foot operated control means which is normally operated in a rhythmic manner, a white noise signal generator, an output system, a gate circuit having an input terminal, an output terminal, and control terminal, a normally inactive timing circuit for generating automatically timed voltage pulses, said timing circuit comprising an electron conductive device coupled to a time delay means including a capacitor and a resistor, circuit means interconnecting said noise generator and said gate input terminal, circuit means interconnecting said gate output terminal and said output system, switching means adapted to be controlled by said foot operated means, circuit means coupling said switching means to said timing circuit, for rendering said timing circuit active to generate delayed voltage pulses, circuit means connected to said gate control terminal and adapted to receive voltage pulses from said timing circuit to briefly open said gate with each pulse received to transmit a noise pulse to said output system, said resistor being adjustable to provide means to select the time interval between the operation of said control means and the first percussive noise sound produced by said output system.

9. In an electronic rhythm instrument having foot operated means for establishing the accented rhythm beat,

a control switch adapted to be operated by said foot operated means, an output system, a first pulse generating circuit, a voltage supply source, said pulse circuit including at least one resistor and one capacitor, circuit means for energizing said pulse circuit, said circuit means interconnecting said voltage source and said pulse circuit and including said switch, circuit means comprising reactive means connecting said pulse circuit to said output system to transmit to said output system a rhythm pulse of selected tone color upon the operation of said foot operated means, and a second pulse circuit to generate a delayed voltage pulse comprising a time delay device responsive to said switch, said second pulse circuit also being connected to said output system for transmitting a delayed pulse to said output system following operation of said foot operated means.

10. In an electronic musical instrument having a foot operated means for establishing the accented rhythm beat, and a delayed pulse generating circuit for establishing the unaccented rhythm beat, a control switch adapted to be operated by said means, an output system, a normally non-energized delayed pulse generating circuit, a voltage supply source having an intermediate voltage tap, said pulse circuit including a gas discharge tube coupled to a capacitor, circuit means including a resistor interconnecting said source and said tube for energizing said pulse circuit, second circuit means interconnecting the intermediate tap of said voltage source and said pulse circuit and including said switch, said switch when operated serving to activate said pulse circuit to generate at least one delayed pulse, a normally inactive gate circuit having an input terminal and an output terminal, a signal voltage generator selectively connected to said input terminal, circuit means interconnecting said output terminal and said output system, said gate circuit being adapted to be rendered active by pulses from said pulse generating circuit to produce at least one delayed rhythm beat in said output system following the operation of said foot operated means.

11. In an electronic rhythm instrument having a pedal keyboard and a single control switch operable by any key of said keyboard, the combination comprising an output amplifier and speaker, a voltage source, a rhythm pulse generator including a discharge device having coupled reactive delay means, first resistive circuit means interconnecting said source and said discharge device, to energize said device, other circuit means interconnecting said source and said discharge device including said switch to render said pulse generator active when said switch is operated and inactive when restored, second resistive circuit means coupling said switch to said source, a capacitor coupling said switch to said output amplifier to transmit a rhythm pulse to said amplifier immediately upon operation of any pedal key, resistive and reactive circuit means interconnecting said discharge device and said amplifier to transmit a delayed rhythm pulse to said amplifier upon the operation of any pedal key.

12. In an electronic rhythm instrument having a pedal keyboard, the combination comprising a movable mechanical member operable by any pedal of said keyboard, a switch operatively coupled to said member, an output amplifier and speaker, a voltage source, an electron conductive device having coupled resistive and reactive time delay means, resistive circuit means interconnecting said source and said electron conductive device to energize said device, other resistive circuit means interconnecting said source and said electron conductive device including said switch to maintain said device in a quiescent state when said switch is nonoperated, resistive and reactive circuit means interconnecting said switch and said output amplifier to transmit an immediate voltage pulse to said amplifier upon operation of any pedal key, resistive and reactive circuit means interconnecting said conductive device and said output amplifier to transmit

a delayed voltage pulse to said amplifier when said device is rendered active by the operation of said switch.

13. In an electronic musical instrument for producing a delayed audio rhythm beat and having a pedal operated control means, an audio output system, a gate device, at least two audio signal generators, selective switching means connecting said signal generators to said gate device, circuit means connecting said gate to said output system, a neon lamp connected in a normally inactive discharge circuit which includes resistive and capacitive delay means, circuit means coupling said pedal control means to said discharge circuit to activate said circuit to provide a delayed discharge upon the operation of said control means, means said gate device being responsive to said delayed discharge to cause said gate to transmit a brief pulse of audio signal to said output system at the moment of said discharge and following the operation of said pedal control means.

14. In an electric rhythm instrument wherein the Down beat tempo is established by a player operated key and the Up beat tempo is timed automatically, a playing key operated electric control unit, an audio output means, a first circuit interconnecting said control unit and said output means comprising an electrical pulse device for generating and transmitting a Down beat pulse to said said output means immediately upon operation of said playing key, a second circuit interconnecting said control unit and said output means comprising a delayed voltage pulse generator for transmitting an automatically timed Up beat pulse to said audio output means following operation of said playing key.

15. In a key operated rhythm device for producing a delayed rhythm pulse, a sub-audible relaxation oscillator, a power supply for said oscillator, said oscillator comprising an electron discharge device and a resistor serially connected to said power supply, a timing capacitor coupled to said discharge device, a voltage divider having a tap connected to said power supply, a normally closed control switch, circuit means including said switch interconnecting said tap and said timing capacitor for holding said oscillator in a normally quiescent condition, means actuated by said key for opening said switch to start said relaxation oscillator for producing at least one delayed rhythm pulse.

16. In a pedal operated rhythm device for producing a delayed rhythm pulse, a delayed voltage pulse generator, a power supply for said generator, said generator comprising a gas tube discharge device and a resistor serially connected to said power supply, a reactive time delay means coupled to said discharge device and to said power supply, a voltage divider having an adjustable tap connected to said power supply, a normally closed control switch, circuit means including said switch interconnecting said tap and said time delay means for holding said generator in a normally inactive condition, means actuated by said pedal for opening said switch to activate said generator for producing at least one delayed rhythm pulse.

17. In a musical instrument having a pedal operated rhythm device for producing a delayed rhythm tone beat, a relaxation oscillator, a power supply for said oscillator, said oscillator comprising an electron discharge device and a resistor serially connected to said power supply, a timing capacitor coupled to said discharge device, a voltage divider having a tap connected to said power supply, a normally closed switch, circuit means including said switch interconnecting said tap and said discharge device for holding said device in a normally inactive condition, means actuated by said pedal for opening said switch to activate said discharge device to produce at least one delayed discharge, at least one tone signal generator, a normally closed gate device, an output system, selective circuit means connecting said generator to said gate, circuit means connecting said gate to said output system, means coupling said electron discharge device

to said gate device in controlling relationship permitting the discharge of said discharge device to open said gate briefly to transmit a delayed rhythm tone beat signal to said output system following the operation of said pedal.

18. In an electric rhythm instrument for producing a player controlled Down beat and an automatically time delayed Up beat, a player operated control means, an audio output system, first circuit means interconnecting said control means and said output system, said first circuit means comprising a pulse generating element for transmitting a Down beat pulse to said audio output system immediately upon operation of said control means, second circuit means interconnecting said control means and said audio output system, said second circuit means comprising a delayed pulse electric generating device for

transmitting an automatically time delayed Up beat pulse to said audio output system upon operation of said control means.

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