March 18, 1969 J. S. SOUTHARD 3,433,880

PERCUSSION SYSTEM

Filed Oct. 20, 1965 Sheet 1 of 3

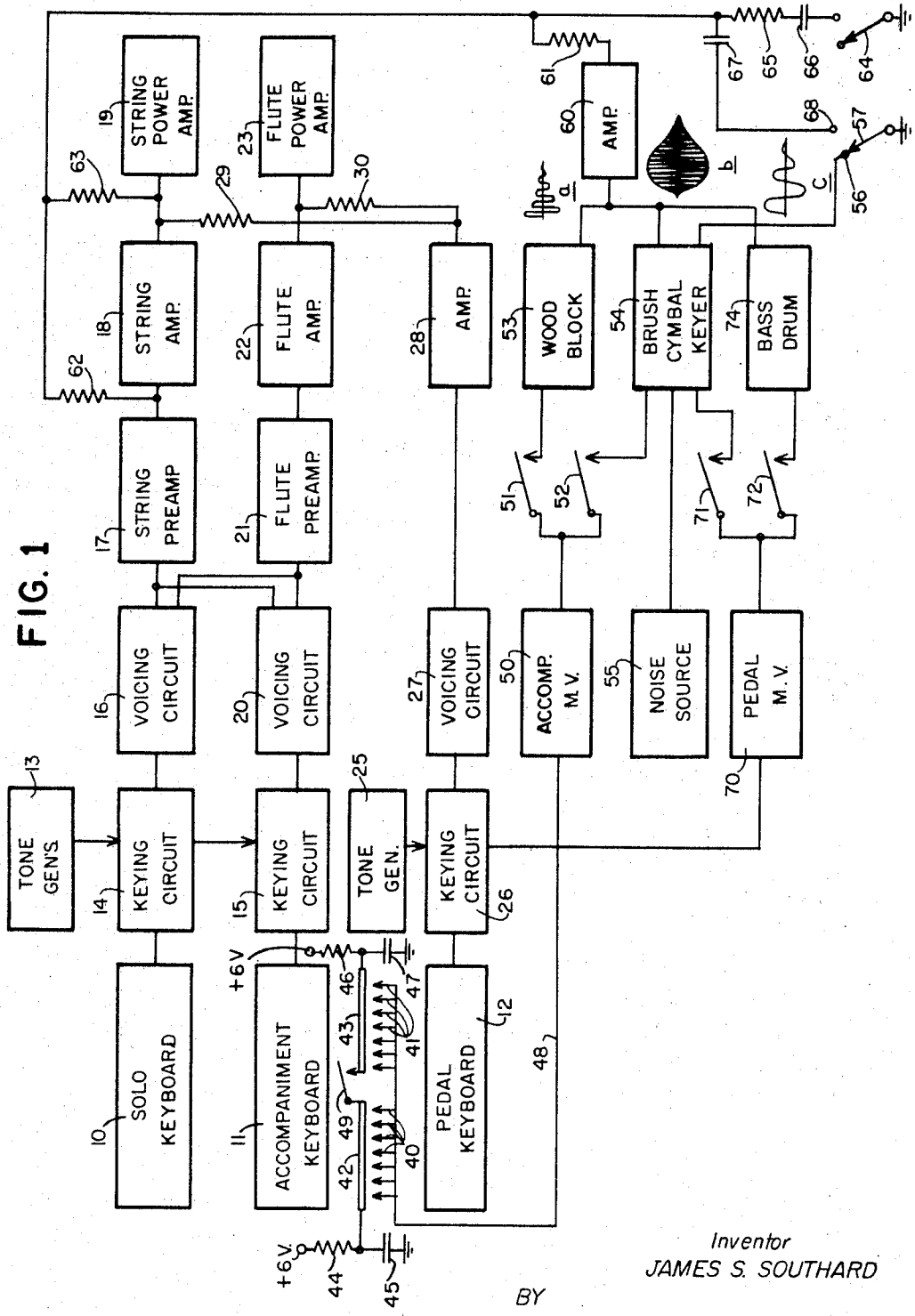


FIG. 1

Inventor
JAMES S. SOUTHARD

BY
Mueller, Aichele & Rauner

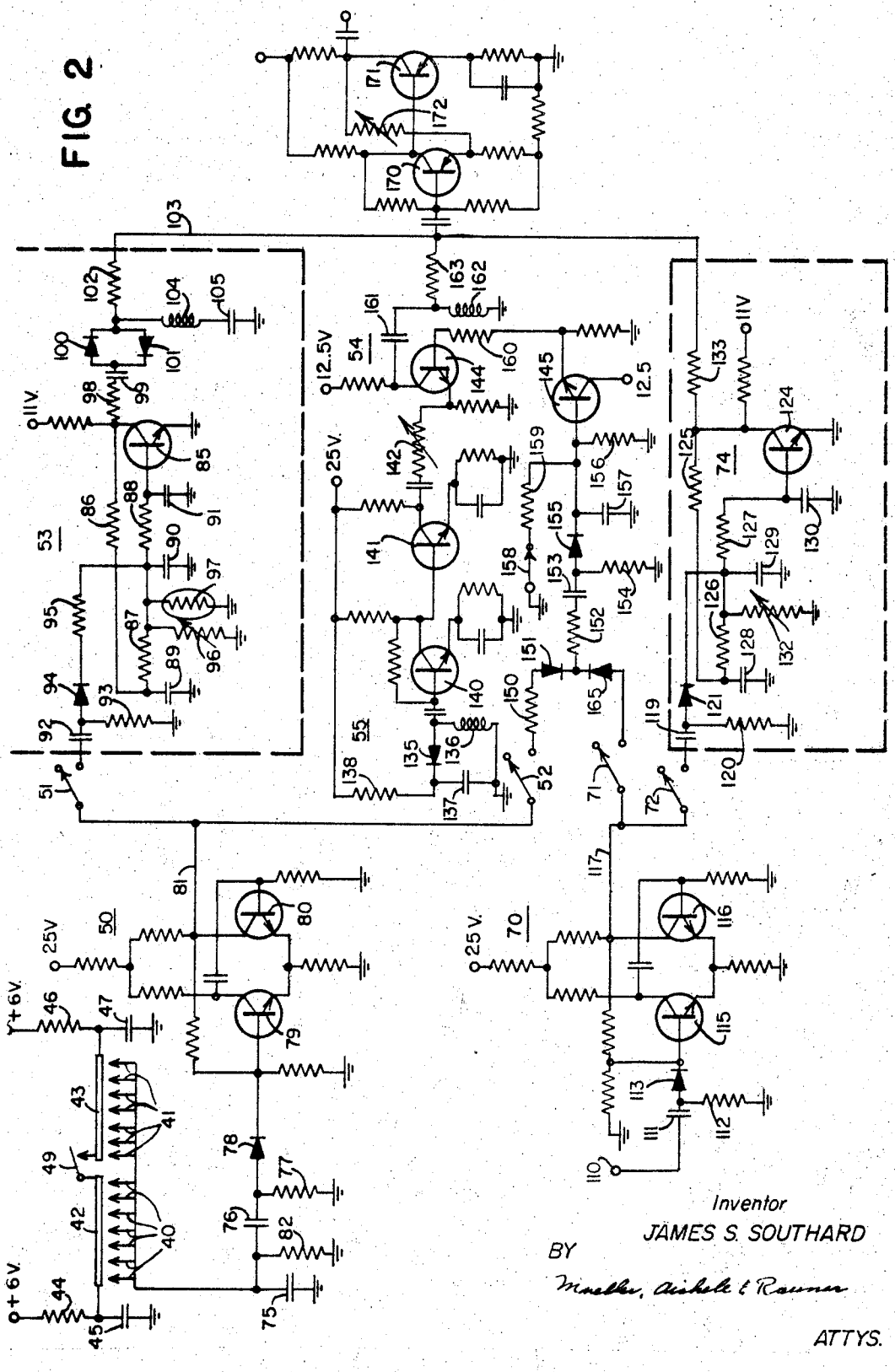
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March 18, 1969 J. S. SOUTHARD 3,433,880

PERCUSSION SYSTEM

Filed Oct. 20, 1965 Sheet 2 of 3

FIG. 2



March 18, 1969 J. S. SOUTHARD 3,433,880

PERCUSSION SYSTEM

Filed Oct. 20, 1965 Sheet 3 of 3

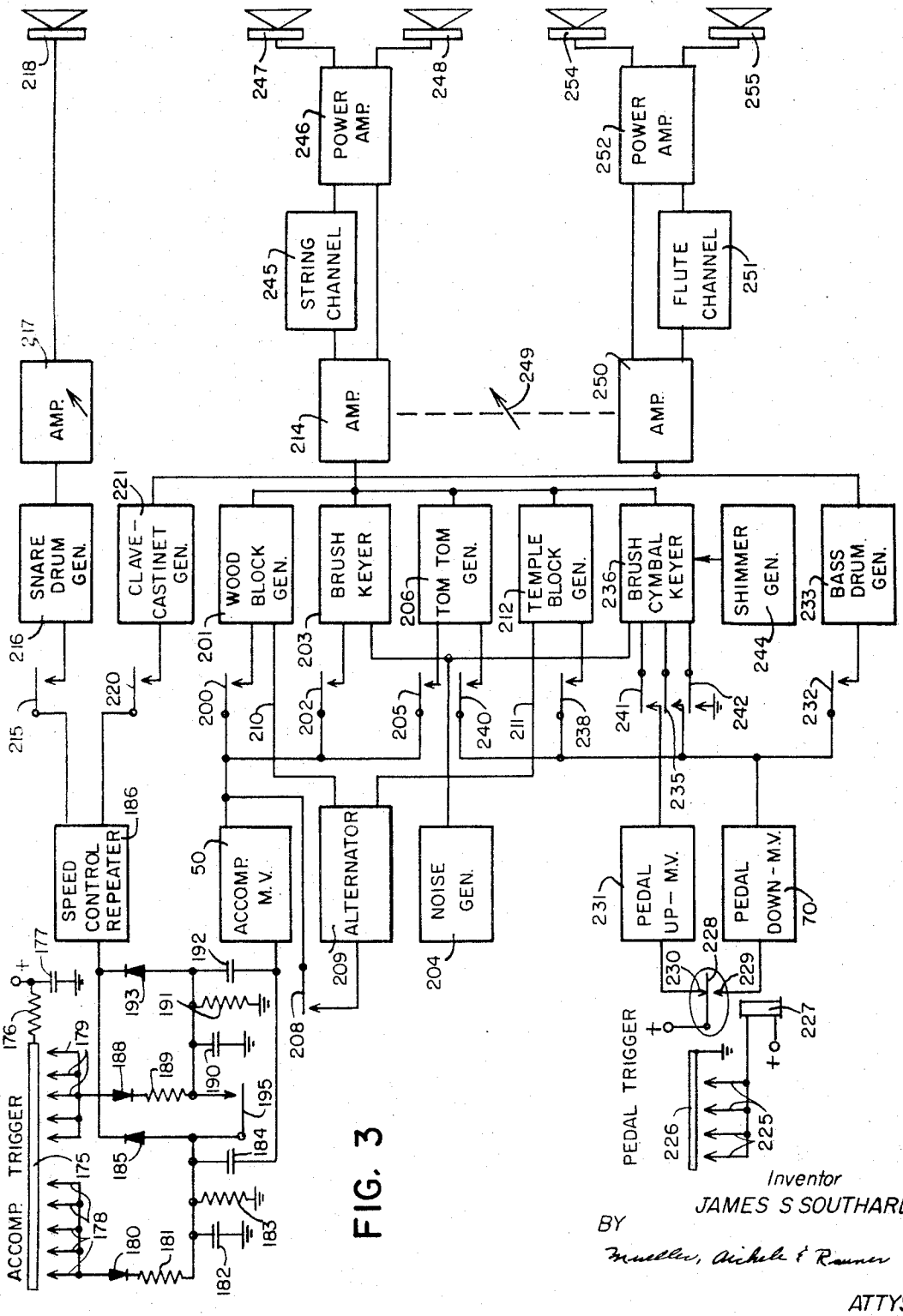


FIG. 3

Inventor
JAMES S SOUTHARD
BY
Mueller, Aichele & Rauner
ATTYS.

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Patented Mar. 18, 1969

3,433,880

PERCUSSION SYSTEM

James S. Southard, Elkhart, Ind., assignor to C. G. Conn Ltd., Elkhart, Ind., a corporation of Indiana

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U.S. Cl. 84—1.17 5 Claims
Int. Cl. G10h 3/06

ABSTRACT OF THE DISCLOSURE

Percussion system for electric organ having generators for producing sounds of drums, blocks and other percussion instruments and noise source for producing signals keyed to provide brush and cymbal sounds. The generators and keyers are actuated by multivibrators controlled by accompaniment and pedal keyboards. Repeat action and production of alternate tones can be selectively provided.

This invention relates generally to percussion units for electric organs, and more particularly to a system actuated by the keys of a keyboard and/or a pedal board of an organ and which selectively produces the sounds of a plurality of different percussion instruments.

Pipe organs as used in theaters and in other places have included provisions for making sounds of percussion instruments, such as drums, blocks, castinets, brush and cymbal. Electric organs have been provided having characteristics similar to that of theater organs, and it is desired to provide the percussion sounds by simple and inexpensive circuits. It is further desired that the sounds be the same or very similar to the sounds produced by the percussion instruments themselves. This requires that the sounds for the different percussion instruments have quite different characteristics. It is also desired that the system be arranged so that the organist can use the sounds as desired without developing new and difficult techniques.

An object of this invention is to provide an improved percussion system for use with an electric organ, and which is actuated by the keys of the organ and provides the sounds of various different percussion instruments.

A further object of the invention is to provide an electric percussion system which can be actuated selectively by the accompaniment manual and by the pedal board of an organ to provide one or more of a plurality of different percussion instrument sounds.

Still another object of the invention is to provide a percussion system for an electric organ which is actuated by the pedal board and which provides percussive sounds when a pedal is operated and/or when a pedal is released.

A still further object of the invention is to provide an improved percussion system wherein percussive sounds can be repeated and/or alternately sounded.

A feature of the invention is the provision of a percussion system having a plurality of tone generators which produce bursts of tone in response to pulses applied thereto, and having multivibrators selectively operated by keys of a manual of the organ and/or a pedal board for providing the actuating pulses.

Another feature of the invention is the provision of a percussive generating system including a noise generator and keyer for providing a burst of signals from the noise generator. The action of the keyer can be controlled by multivibrators actuated by keys of an organ which also actuate other generators for producing percussive sounds, and may be further controlled by a shimmer generator to produce desired brush sounds.

A further feature of the invention is the provision of a percussion actuating system for operation by the accompaniment manual of an organ which provides an actuating pulse in response to operation of a key below middle

C and a further actuating pulse in response to operation of a key above middle C. An alternator can be used to apply the actuating pulses to two generators in turn to provide two percussive sounds alternately.

A still further feature of the invention is the provision of a percussion system including a switch device operated by keys of the pedal board of an organ and which closes a first contact when a key is operated and a second contact when a key is released, with the contacts being selectively connected to produce actuating pulses to cause percussive sounds.

The invention is illustrated in the drawings wherein:

FIG. 1 illustrates in block diagram an electric organ with the percussion system of the invention coupled thereto;

FIG. 2 is a circuit diagram of the percussion system of FIG. 1; and

FIG. 3 is a block diagram of a more complex percussion system.

In practicing the invention there is provided a percussion system for an electric organ for producing various percussive sounds as the organ is played. A plurality of generators produce the sounds of drums, blocks and other percussion instruments. A noise source produces signals which are keyed to provide brush and cymbal sounds. The percussion sound tone generators and the keyer are actuated by multivibrators controlled respectively by the keys of the accompaniment keyboard and the pedal board. The multivibrator for the accompaniment keyboard is actuated by the individual keys and may be actuated by operation of a key below middle C and again by operation of a key above middle C. A repeater may be provided for repeatedly actuating the generators, and the accompaniment multivibrator may be connected to an alternator for initiating two tones in turn, such as the wood block and the temple block sounds. The pedal multivibrator can be actuated from a pedal tone keyer or from separate contacts provided on the pedals. A double throw switching device can be used to actuate a first pedal multivibrator when a pedal is depressed and to actuate a second pedal multivibrator when the pedal is released, as may be desired for brush and cymbal sounds.

In FIG. 1 there is shown a block diagram of an organ having a percussion or rhythm section in accordance with the invention. The organ illustrated includes a solo keyboard or manual **10**, an accompaniment keyboard or manual **11**, and a pedal board **12**. A plurality of tone generators **13** apply tones to a keying circuit **14** controlled by the keys on the solo keyboard **10**, and to a keying circuit **15** controlled by the keys on the accompaniment keyboard **11**. The signals passed by the keying circuit **14** are applied to a voicing circuit **16**, with string and reed type tone signals being applied through the string preamplifier **17** and the string post amplifier **18** to the string power amplifier **19**. The flute tone signals from the voicing circuit **16** are applied through the flute preamplifier **21** and the flute post amplifier **22** to the flute power amplifier **23**. Signals applied through keying circuit **15** by control of the accompaniment keyboard **11** are applied to voicing circuit **20**, and to the string preamplifier **17** and the flute preamplifier **21** in the same manner as the signals from the voicing circuit **16** for the signals from the solo keyboard.

A separate tone generator **25** applies tone signals to a keying circuit **26** controlled by the keys or pedals on the pedal board **12**. The pedal tone signals are applied through voicing circuit **27** and pedal amplifier **28**, and then through resistor **29** to the string power amplifier **19**, and through resistor **30** to the flute power amplifier **23**. The organ system which has been described has been used for a period of years.

The percussion or rhythm section for the organ makes

use of an additional contact which is provided on the keys on the accompaniment keyboard **11**. These contacts are numbered **40** for the keys below middle C and **41** for the keys above middle C. The contacts **40** are arranged to engage a fixed contact **42**, and the contacts **41** engage a fixed contact **43**. The contact **42** is connected to the junction between resistor **44** and capacitor **45**, which provides a positive potential to the contact **42**. The contact **43** is similarly connected between resistor **46** and capacitor **47** which provides a positive potential thereto. The movable contacts **40** and **41** are all connected through the single conductor **48** to the accompaniment multivibrator **50** for actuating the same.

The accompaniment multivibrator **50** applies a pulse of fixed amplitude and duration in response to actuation of any key of the accompaniment keyboard. The accompaniment multivibrator **50** is connected through separately actuated switches **51** and **52** to the wood block generator **53** and the brush-cymbal keyer **54** respectively. Each time an actuating pulse is applied to the wood block generator **53**, a decaying burst of tone having a frequency of the order of 590 cycles per second is produced thereby. This is represented by the waveforms *a* to the right of the wood block generator **53**.

A noise generator **55** provides noise having a gaussian distribution around 20 kilocycles which is applied to the brush-cymbal keyer **54**. When the switch **52** is closed, a pulse from the multivibrator **50** actuates the keyer **54** to pass a decaying burst of noise as shown by the wave *b* to the right of the keyer **54**. The keyer **54** is connected to switch contact **56** which is grounded by switch arm **57** for short sustain of the brush-cymbal burst. When the contact **57** is ungrounded, long sustain is provided.

The outputs of the wood block generator **53** and of the keyer **54** are applied to amplifier **60** which has variable gain to control the level of the signal. The output of amplifier **60** is applied to the string post amplifier **18** of the organ audio system by resistors **61** and **62**. This signal is also applied to the string power amplifier **19** through resistors **61** and **63**. The output of the string post amplifier **18** is applied to the string power amplifier **19**. This provides control of the level by the string post amplifier **18** as well as by the amplifier **60**. The level of the signals is further controlled by switch **64**. When this switch is closed, the signal at the output of amplifier **60** is divided by the action of resistor **61** and the series circuit including resistor **65** and capacitor **66**. When the switch contact **57** is in the long sustain position and engages contact **68**, capacitor **67** is connected in parallel with resistor **65** and capacitor **66** to further divide down the signal, particularly at the higher frequencies.

The percussion system is also actuated by the pedal manual of the organ. Pedal keyer **26** is actuated when any pedal is operated. The keyer **26** is coupled to monostable multivibrator **70**, which is generally similar to the multivibrator **50**. This provides a pulse of a predetermined amplitude and duration each time a pedal key is operated. The multivibrator **70** is connected to separately operated switches **71** and **72**. Switch **71** connects the multivibrator **70** to the keyer **54** so that this keyer applies brush-cymbal percussive bursts as has been described in connection with the operation of keys on the accompaniment manual. Switch **72** applies a pulse from the multivibrator **70** to the bass drum generator **74** which produces a burst of tone having a frequency of the order of 66 cycles per second. A decaying burst is produced each time a pulse is applied thereto as presented by the curve *c* at the right of the generator **74**. The output of the bass drum generator **74** is also applied to the amplifier **60** together with the outputs of the wood block generator **53** and the brush-cymbal keyer **54**.

FIG. 2 shows the circuit diagram of the percussion system of FIG. 1. The keys of the accompaniment manual of the organ have contacts **40** and **41** individually operated by the keys as described in connection with FIG. 1. Operation of any one of the contacts **40** will charge the capacitor **75** by connecting the same in parallel with capacitor **45** which is charged through resistor **44** from the +6 volt terminal. The voltage across capacitor **75** is applied to the differentiating circuit including capacitor **76** and resistor **77** and positive differentiated pulses will be applied through diode **78** to the base of transistor **79** of the accompaniment multistable multivibrator **50**. Only one pulse is provided each time a contact **40** is closed until all contacts **40** are released. However, resistor **82** discharges capacitor **75** so that closing of a contact **41** connects the capacitor **75** in parallel with capacitor **47** which is charged through resistor **46** from the +6 volt supply. This will provide a new voltage pulse across capacitor **75** which is applied to the differentiating circuit **76**, **77** to provide a pulse through diode **78** to again trigger the multivibrator **50**.

The multivibrator **50** is of known construction and includes transistors **79** and **80**. Transistor **79** conducts in response to the trigger pulse to cut off transistor **80** so that a voltage pulse appears at the collector of transistor **80** which is applied through conductor **81** to the switches **51** and **52** previously described.

The wood block oscillator **53** is of the phase shift type including transistor **85** having a three mesh ladder line connecting the collector thereof to the base. This includes resistors **86**, **87** and **88**, and capacitors **89**, **90** and **91**. The pulse applied through switch **51** is differentiated by capacitor **92** and resistor **93**, with the positive pulse being applied through diode **94** and resistor **95** to the second mesh of the phase shift network (across capacitor **90**). The series resistor **95** acts to soften the attack of the oscillator. The negative differentiated pulse is blocked by the diode **94**. The frequency of the oscillator depends upon the constants of the ladder line which forms the feedback circuit, and the decay depends upon the setting of the resistor **96** which is bridged across capacitor **90**, and which controls the Q of the feedback circuit. The thermistor **97** serves to temperature compensate the Q for temperature changes.

The output from the oscillator is derived from the collector of transistor **85** and applied through resistor **98**, capacitor **99**, the parallel limiting diodes **100** and **101** and output leveling resistor **102** to the output bus **103**. The diodes **100** and **101** act to eliminate noise. A series resonant circuit including inductor **104** and capacitor **105** acts to reshape the clipped waveform from the noise elimination diodes to provide the desired waveform.

The pedal multivibrator **70** is generally similar to the accompaniment multivibrator **50**. As shown in FIG. 1 this is operated from a keying circuit rather than from switch contacts operated by the pedals. Terminal **110** is connected to the pedal keying circuit, and a voltage thereon is applied to the differentiating circuit including capacitor **111** and resistor **112**. The positive differentiated pulse is applied through diode **113** to the transistor **115** of the multivibrator. This acts to cut off normally conductive transistor **116** to produce a pulse at its collector which appears on conductor **117**. Transistors **115** and **116** operate in the same manner as transistors **79** and **80** of monostable multivibrator **50**.

Switch **72** actuates the bass drum generator **74** as described in connection with FIG. 1. This switch applies the pulse on conductor **117** to a differentiating circuit including capacitor **119** and resistor **120**. The positive differentiated pulse is applied through diode **121** to the phase shift oscillator.

The bass drum oscillator itself includes transistor **124** having its collector connected through a ladder line to its base. The ladder line includes resistors **125**, **126** and **127** and capacitors **128**, **129** and **130**. The frequency of the oscillator, which is previously stated is of the order of 66 cycles per second, is controlled by the constants of the ladder line. Variable resistor **132** controls the decay of the oscillations by control of the Q of the feedback

circuit. The output of transistor **124** is applied from the collector thereof through level control resistor **133** to the output bus **103**.

The noise source **55** for producing brush-cymbal sounds is formed by diode **135**, inductor **136** and capacitor **137**. The diode **135** is back biased from the 25 volt supply through resistor **138** and produces shot noise, recombination noise and $1/f$ noise, which is developed across the inductor **136**. This noise is applied to the amplifiers including transistors **140** and **141**, with the level being controlled by variable resistor **142** which couples signals from transistor **141** to transistor **144**. The amplified noise signal is applied to the emitter of transistor **144** which functions as the gate of the keyer. The keyer is rendered operative when a pulse is applied to the base electrode of transistor **144** from emitter follower transistor **145**. When the keyer is actuated from the accompaniment manual by the connection through switch **52**, the pulse from the monostable multivibrator **50** is applied through resistor **150**, diode **151** and resistor **152** to the coupling circuit including capacitor **153** and resistor **154**. The positive pulse is applied across diode **155** and capacitor **157**, which functions as an integrating circuit to stretch the pulse. The pulse is then applied in parallel to resistor **156** and the emitter follower **145**. When switch contact **158** connects resistor **159** in parallel with resistor **156**, the pulse stretcher capacitor discharges more rapidly to provide a short sustain of the brush-cymbal sound. When the switch **158** is open, the resistance of the discharge path is greater and a longer sustain is provided. The emitter follower transistor **145**, when conducting, applies pulses through resistor **160** to the base of the gate transistor **144** so that the noise is passed thereby to the series resonant circuit including capacitor **161** and coil **162**. The output across the coil **162** is applied through resistor **163** to the output bus **103**.

When switch **71** is closed so that a pulse is applied to the noise keyer from the pedal monostable multivibrator, the pulse is applied through diode **165** and resistor **152** to the coupling circuit including capacitor **153** and resistor **154**. This path does not include resistor **150** or a similar resistor so that a longer duration pulse is provided to produce a longer brush-cymbal sound when initiated by the pedal monostable multivibrator. This pulse is stretched by capacitor **157** and then applied to the emitter follower transistor **145**. Switch **158** further controls the sustain, as previously described.

The output from bus **103** is applied to an amplifier including transistors **170** and **171**. Resistor **172** controls the feedback between the stages and is adjustable to provide control of the amplifier gain.

In FIG. 3 there is shown a more complex percussion system which includes the features of the system of FIGS. 1 and 2 as previously described, and additional features. The accompaniment multivibrator **50**, which may operate the same as the multivibrator **50** in the systems of FIGS. 1 and 2, is actuated from the accompaniment keyboard through a circuit which differs somewhat from the circuit shown in FIGS. 1 and 2. The contact **175** common to all of the keys is connected through resistor **176** to a positive potential which is bypassed by capacitor **177**. Contacts **178** are associated with the keys of the accompaniment keyboard below middle C, and contacts **179** are associated with the keys above middle C. When any of the contacts **178** engages the contact **175**, the potential from contact **175** is applied through diode **180** and resistor **181** to charge capacitor **182**. Resistor **183** is provided to discharge the capacitor **182** and provide the desired time constant. The pulse developed by the charging of capacitor **182** is applied through capacitor **184** to the accompaniment multivibrator **50**, and the D.C. component is applied through diode **185** to a repeater circuit **186**.

When a key above middle C is operated, one of the contacts **179** will provide a potential from contact **175** through diode **188** and resistor **189** to charge capacitor **190**. Resistor **191** provides the desired time constant. The pulse across capacitor **190** is applied through capacitor **192** to the accompaniment multivibrator **50**, and the D.C. component is applied through diode **193** to the repeater **186**. The accompaniment multivibrator **50** and the repeater **186** will, therefore, each be actuated when a keyer on the accompaniment manual is operated. After one key is operated, operation of a second key will not cause a further pulse across capacitor **190** unless it is on the opposite side of the middle C break. A switch **195** is provided to connect the two sections so that a second pulse cannot be produced until all keys of the manual are released and a key is then operated.

The accompaniment multivibrator **50** operates as previously described to produce an actuating pulse for the percussion generators. Accompaniment multivibrator **50** is connected through switch **200** to wood block generator **201**, which may be the same as wood block generator **53** in FIG. 1. The accompaniment multivibrator is connected through switch **202** to brush keyer **203**. The brush keyer selectively applies signals from the noise generator **204**, and the noise generator and brush keyer can be identical to the noise generator **55** and brush keyer **54** in FIG. 1. The multivibrator **50** is also connected through switch **205** to the tom-tom generator **206**. The tom-tom generator may be generally similar to the wood block generator and the bass drum generator, and has a frequency of the order of 173 cycles per second.

The accompaniment multivibrator **50** is connected through switch **208** to the alternator **209**. The alternator may be a flip-flop circuit, which responds to applied pulses to alternately apply pulses to output conductors **210** and **211**. Output conductor **210** is connected to wood block generator **201** and output conductor **211** is connected to temple block generator **212**. The temple block generator may be of the same construction as the wood block generator but has a higher frequency which may be of the order of 750 cycles per second. Accordingly, when switch **208** is closed, repeated operation of keys of the accompaniment manual to produce repeating pulses from the accompaniment multivibrator **50** will cause alternator **209** to alternately actuate the wood block generator **201** and the temple block generator **212**. Therefore, the tones produced by these generators will be alternately applied to the amplifier **214**.

The repeater **186** is connected by switch **215** to snare drum generator **216** and by switch **220** to clave-castinet generator **221**. The repeater **186** can be an astable multivibrator having a frequency of the order of 0 to 20 cycles per second. A variable control is provided for the repeater which can be adjusted by the organist to the desired repetition speed. Accordingly, when a note is played on the accompaniment manual, the D.C. voltage pulse will cause the repeater to operate continuously until the pulse is terminated. It is noted that the pulses are not applied to the repeater through a capacitor so that they are not differentiated to produce a single trigger pulse, as are the pulses applied to the accompaniment multivibrator **50**.

The snare drum generator may be similar to the wood block generator **53** and bass drum generator **74** shown in FIG. 2, and has a frequency of the order of 166 cycles per second. The output of the snare drum generator is applied through an amplifier **217** to a speaker **218**. The speaker **218** can be specially designed to reproduce the sound of a snare drum.

The clave-castinet generator can be similar to the generator previously described but has a relatively high frequency of the order of 2500 cycles per second. This will be operated repeatedly by the repeater **186** as long as the actuating pulse is applied thereto.

The pedal multivibrator **70** is actuated by operation of the pedals through switch contacts **225** connected thereto. These contacts engage the fixed contact **226** which is at ground potential. Operation of any pedal causes actuation of relay **227** so that the sealed reed contact **228**

thereof engages down contact 229. This applies a positive pulse to the pedal multivibrator 70 to actuate the same each time a pedal is operated. When the pedal is released, the reed contact 228 returns into engagement with the upper contact 230. This applies a pulse to the pedal up multivibrator 231 to actuate the same.

The pedal down multivibrator 70 is connected through switch 232 to the base drum generator 233. Bass drum generator 233 can be identical to the bass drum generator 74 shown in FIG. 2, and is actuated by the multivibrator 70 in exactly the same manner. The pedal multivibrator 70 is connected through switch 235 to the brush-cymbal keyer 236. The brush-cymbal keyer is connected to the noise generator 204 and operates in the manner previously described in connection with FIG. 2. The pedal multivibrator 70 is connected through switch 238 to the temple block generator 212, and through switch 240 to the tom-tom generator 206, which have previously been described. Accordingly, actuation of the pedal multivibrator causes operation of the bass drum generator, the brush-cymbal keyer, the temple block generator and the tom-tom generator, when the switches 232, 235, 238 and 240 are closed. The switches are provided as stops for the organist to control so that any one or more can be operated at any time.

The pedal up multivibrator 231 is connected through switch 241 to the brush-cymbal keyer 206. Accordingly, the brush-cymbal keyer can be operated when a pedal has been operated and is released. When both switches 235 and 241 are both closed, the keyer 236 will be operated when a pedal is operated and again when it is released. Operation of either of these switches will cause the keyer to operate at one or the other of the times.

The brush-cymbal keyer is also connected to switch 242 which selectively grounds a terminal of the brush-cymbal keyer to provide short sustain of the burst of noise signal provided by the keyer. This switch is equivalent to the switch 158 in FIG. 2 which controls the sustain of the keyer 54. In the system of FIG. 3, a separate keyer is provided for the accompaniment brush sound and for the pedal brush-cymbal sound. This makes it unnecessary to change the operation of the keyer when actuated by the accompaniment and pedal multivibrators. The brush-cymbal keyer 236 is also controlled by shimmer generator 244. This is a generator which provides a frequency of the order of 14 cycles per second, which modulates the amplitude of the noise signals passed by the keyer, to provide a shimmer effect.

The outputs of the wood block generator 201, the brush keyer 203, the tom-tom generator 206, the temple block generator 212 and the brush-cymbal keyer 236 are all fed to amplifier 214. The output of amplifier 214 is applied to the string channel post amplifier 245 and to the string power amplifier 246. The output of the string channel post amplifier 245 is also applied to the power amplifier 246. This is generally the same connection shown in FIG. 1, but in that system all of the percussion sounds are applied to the string channel. The string power amplifier 245 drives one or more loudspeakers indicated as 247 and 248. The output of the clave-castinet amplifier 221 and of the bass drum generator 233 are applied to amplifier 250. Amplifiers 214 and 250 may have a common gain control, as indicated by the arrow 249. The output of amplifier 250 is applied to the flute channel of the organ, being applied to the flute channel post amplifier 251 and to the power amplifier 252. The flute channel post amplifier 251 output is also applied to the power amplifier 252. This permits control of the output both by the amplifier 250 and by the flute channel post amplifier 251. The output of the power amplifier 252 is applied to loudspeakers 254 and 255. One of these speakers may be a speaker including a rotating member to provide a tremolo effect, as is commonly used in the flute channel of an organ.

The percussion system which has been described may be provided in various different forms, as illustrated by the simple form shown in FIG. 1, and the more complex form shown in FIG. 3. In each case, generators providing the sounds of percussive instruments are selectively actuated by multivibrators controlled by the accompaniment manual and the pedal board of an organ. Various different generators for simulating various instruments can be provided as may be desired in a particular application. The accompaniment manual can control the generators through a repeater to provide the repeated sounds of a snare drum and clave-castinet. An alternator can be used to give alternate sounds of different types, such as alternate wood block and temple block sounds. The generators when controlled by the pedals can operate when a pedal is depressed and/or when a pedal is released. This provides a wide latitude in arrangements which can be made.

I claim:

1. A percussion system for an electronic organ having keys for producing notes of a musical scale and sound reproducing means, said system including in combination, trigger means for providing a trigger pulse in response to operation of a key, alternator means having first and second terminals and responsive to successive trigger pulses to alternatively provide actuating pulses at said first and second terminals, first and second generators coupled to the sound reproducing means for applying thereto signals of different frequencies, each of said tone generators being responsive to the application of an actuating pulse thereto to produce a signal pulse, and means connecting said first and second terminals to said first and second generators respectively so that signals are alternatively applied therefrom to the sound reproducing means by operation of the organ keys.

2. A percussion system for an electronic organ having keys on a manual for producing notes of a musical scale which extend above and below a reference note, and sound reproducing means, said system including in combination, trigger means for providing an actuating pulse, means coupled to said trigger means and responsive to operation of the keys to actuate said trigger means, with operation of a key for a note below the reference note causing actuation of said trigger means and operation of a key for a note above the reference note causing a further actuation of said trigger means, a plurality of generator means coupled to the sound reproducing means for applying thereto signals of different frequencies, each of said generator means being responsive to the application of an actuating pulse thereto to produce a signal pulse, and switching means selectively connecting said trigger means to said generators so that signal pulses are selectively applied to the sound reproducing means by operation of the keys.

3. A percussion system for an electronic organ having keys on a manual for producing notes of a musical scale which extend above and below a reference note, and sound reproducing means, said system including in combination, trigger means for providing an actuating pulse, actuating means coupled to said trigger means and responsive to operation of the keys to actuate said trigger means by operation of a key for a note below the reference note and again by operation of a key for a note above the reference note, a plurality of generator means coupled to the sound reproducing means for applying thereto signals of different frequencies, each of said generator means being responsive to the application of an actuating pulse thereto to produce a signal pulse, a noise generator, keyer means coupled to said noise generator for selectively applying noise signals therefrom to the sound reproducing means, and switching means selectively connecting said trigger means to said generator means and to said keyer means, so that signal pulses are selectively applied to the sound reproducing means by operation of the keys.

4. A percussion system for an electronic organ having keys provided by at least one manual and a pedal board, and sound reproducing means, said system including in

combination, first trigger means for providing an actuating pulse in response to operation of a key of the manual, second trigger means for providing an actuating pulse in response to operation of a pedal key, third trigger means for providing an actuating pulse in response to release of an actuated pedal key, a plurality of generators coupled to the sound reproducing means for applying thereto signals of different frequencies, each of said generators being responsive to the application of an actuating pulse thereto to produce a signal pulse, and switching means selectively connecting said first, second and third trigger means to said generators so that signal pulses are selectively applied to the sound reproducing means by operation of the keys of the manual and pedal board.

5. A percussion system for an electronic organ having keys provided by at least one manual and a pedal board, and sound reproducing means, said system including in combination, first trigger means for providing an actuating pulse in response to operation of a key of the manual, said first trigger means including means providing repeated actuating pulses, second trigger means for providing an actuating pulse in response to operation of a pedal key and in response to release of an operated key, a plurality of generators coupled to the sound reproducing means for applying thereto signals of different frequencies, each of said tone generators being responsive to the application of an actuating pulse thereto to produce a signal pulse, generator means producing

random noise signals, keyer means coupled to said generator means for selectively applying said random noise signals to the sound reproducing means, said keyer means being responsive to the application of an actuating pulse to provide a burst of random noise signals having predetermined attack and decay characteristics, alternator means connected to a pair of said tone generators for applying actuating pulses thereto in turn in response to successive actuating pulses applied to said alternator means, and switching means selectively connecting said first and second trigger means to said generators, said keyer means and said alternator means, so that signals are selectively applied to the sound reproducing means by operation of the keys of the manual and pedal board.

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JOHN S. HEYMAN, *Primary Examiner.*

B. P. DAVIS, *Assistant Examiner.*

U.S. Cl. X.R.

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