KEYBOARD ACTUATED RHYTHM ACCOMPANIMENT

Filed May 18, 1967 3 Sheets-Sheet 1

Fig. 1.

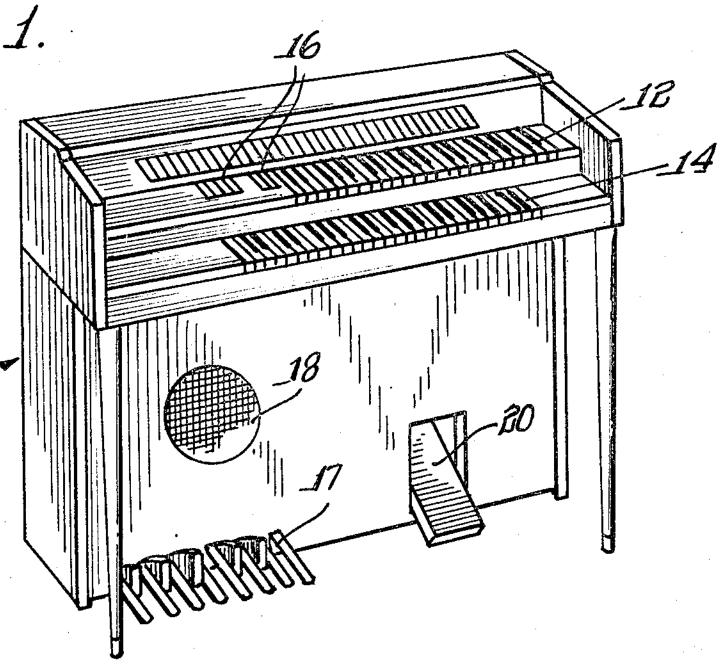
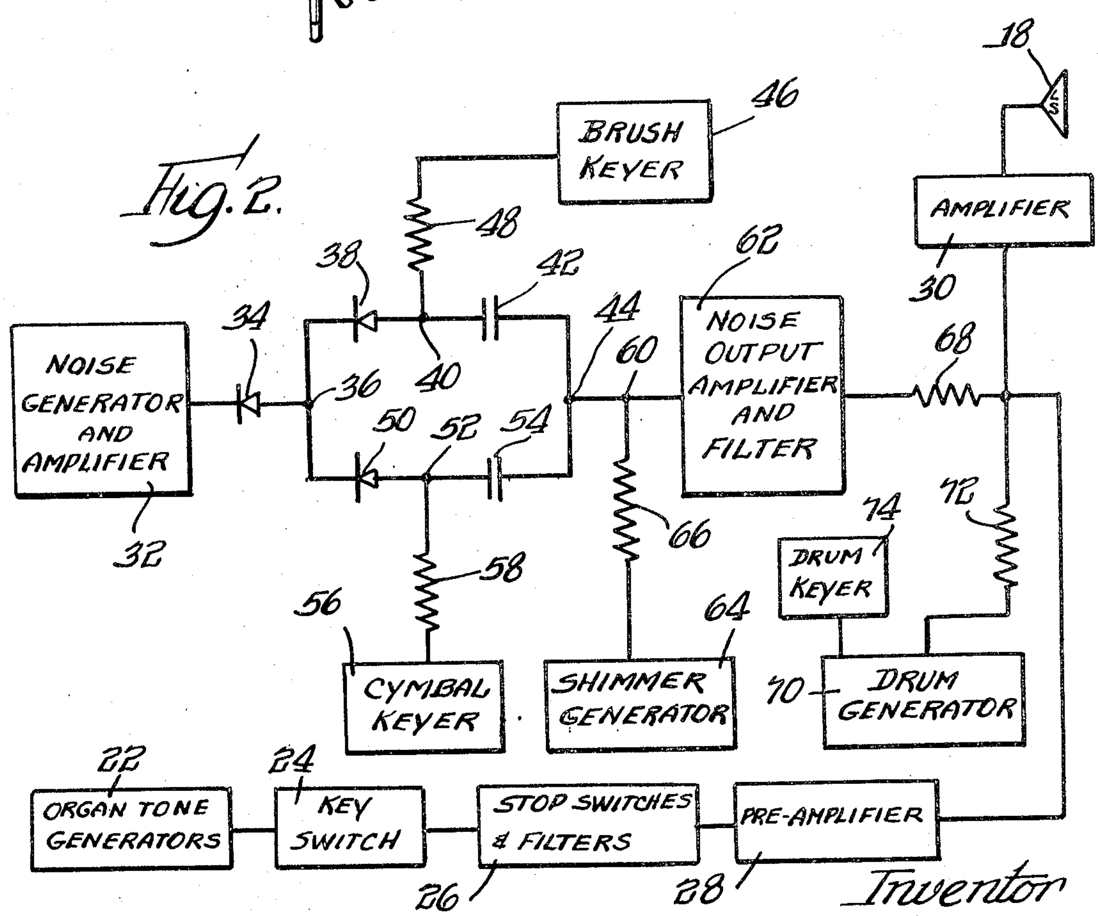


Fig. 2.



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KEYBOARD ACTUATED RHYTHM ACCOMPANIMENT

Filed May 18, 1967 3 Sheets-Sheet 2

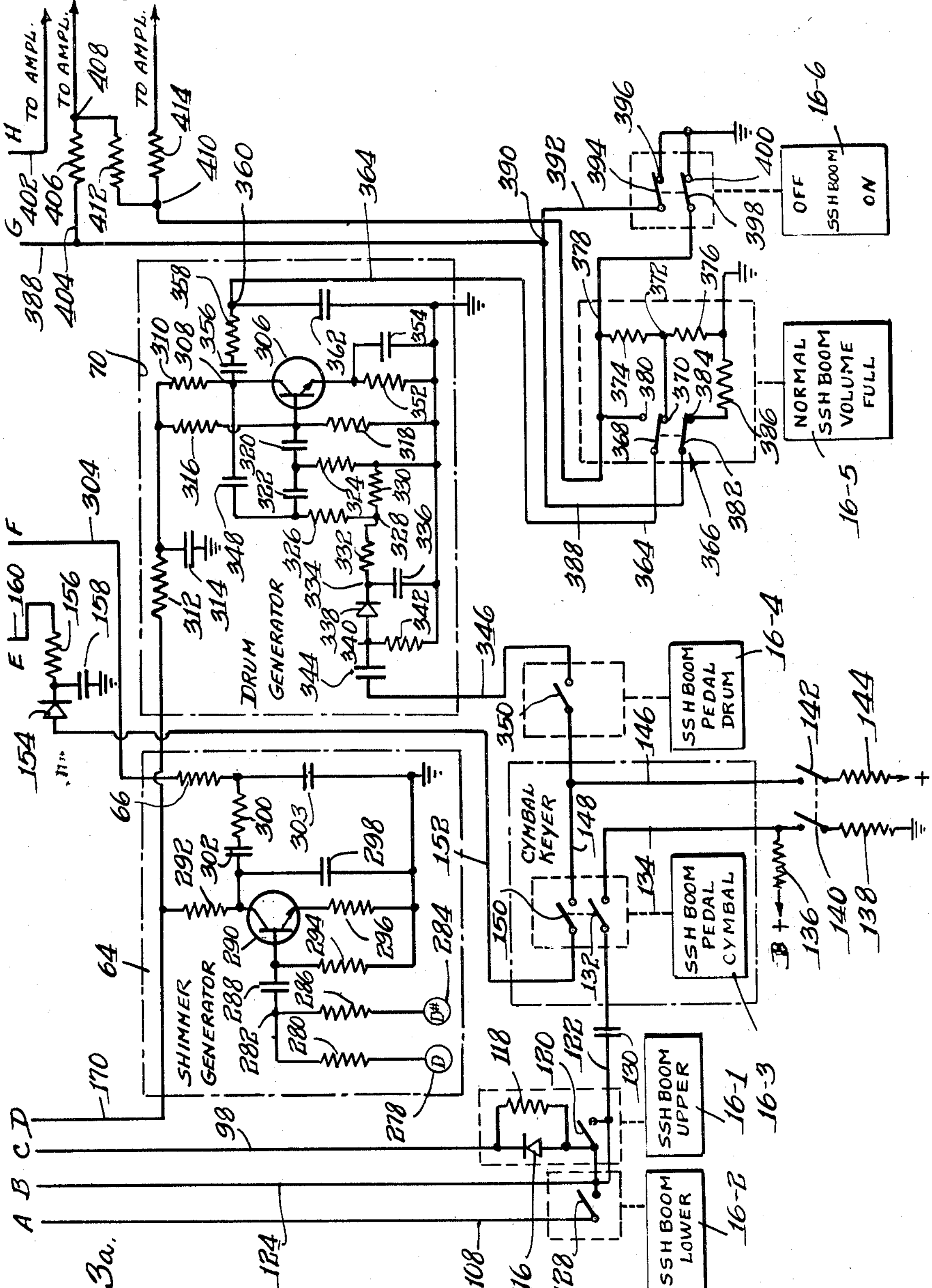

Fig. 3a.

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KEYBOARD ACTUATED RHYTHM ACCOMPANIMENT

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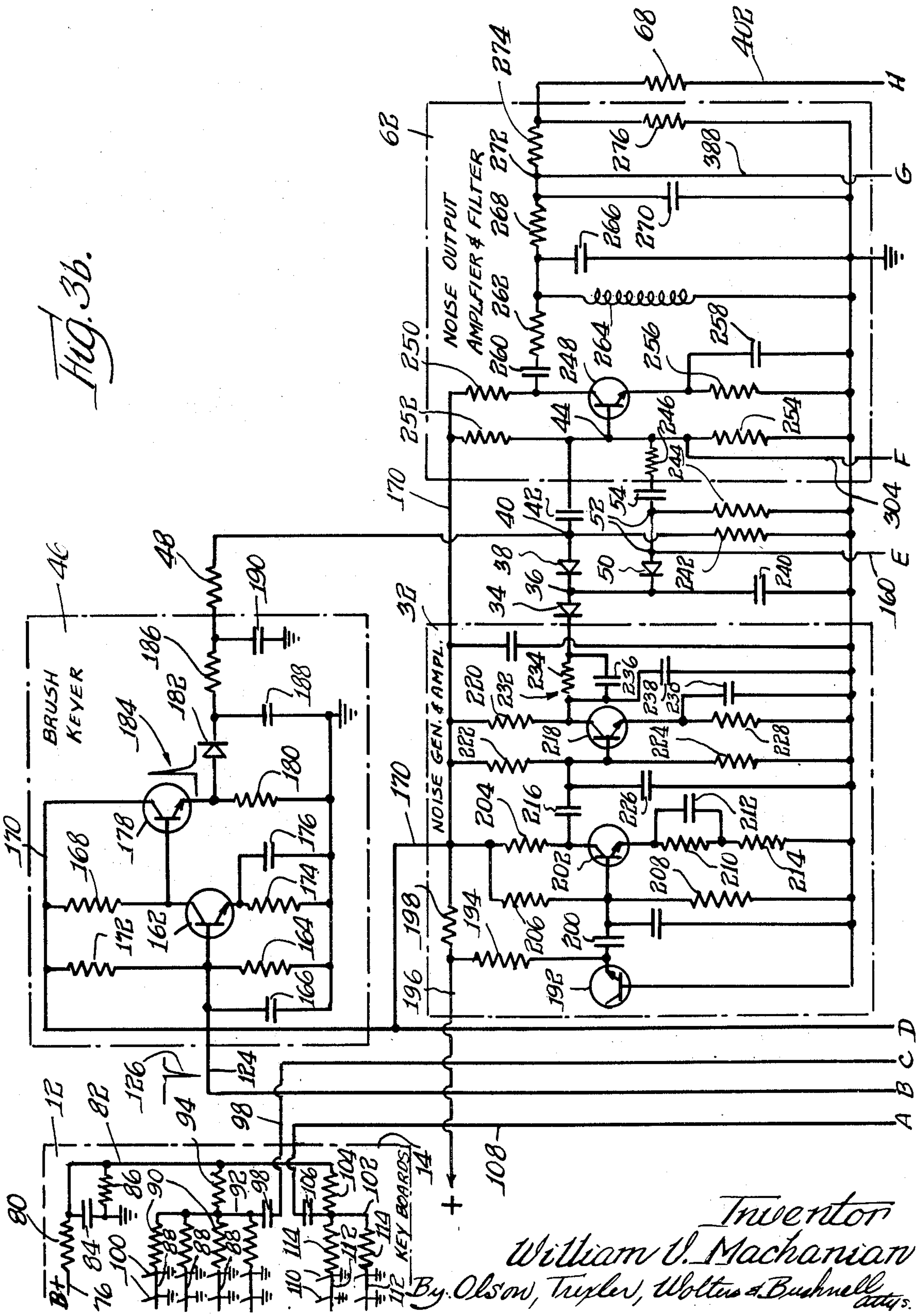

Fig. 3b.

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3,520,984

KEYBOARD ACTUATED RHYTHM ACCOMPANIMENT

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Filed May 18, 1967, Ser. No. 639,518
Int. Cl. G10h *1/00, 1/02*
U.S. Cl. 84—1.24 9 Claims

ABSTRACT OF THE DISCLOSURE

Electronic circuits forming a part of an electronic organ for producing percussive tones such as drums, blocks, brushes, cymbals and the like, concurrently with the musical or melody notes and keyed by the keys of the manuals and by the pedals.

It is common practice to provide small dance bands or musical combinations for producing or playing popular music for dancing or for entertainment. One or more instruments may be used to play the melody, and, in addition, there preferably is a rhythm accompaniment, produced by one or more musicians operating with various percussive type sound generators, such as drums, blocks, brushes, cymbals, and the like. Such rhythm accompaniment is of a repetitive nature, differing in accordance with the nature of the music, i.e., fox-trot, samba, cha-cha, etc.

Often a small club or the like simply cannot afford the expense of more than one musician. This musician will often play an electronic organ, since it provides the most versatile effects. In order to provide the highly desirable rhythm accompaniment, various rhythm devices have been developed, and insofar as I am aware, the first of these was sold commercially by The Wurlitzer Company and known as the "Sideman" rhythm device. This device is disclosed and claimed in U.S. Letters Patent No. 3,207,835 in the names of Holman, Hearne, and Korinke, and it further is disclosed and claimed in Joseph H. Hearne patent application for Rhythm Device, Ser. No. 580,504, now Pat. No. 3,358,069, filed Sept. 19, 1966. The "Sideman" rhythm device referred to is a separate unit.

In order to conserve space, and to produce results in strict conformity with a player's timing, and for other desirable purposes, further advances were made wherein electronic generators simulating the sounds of drums, blocks, cymbals, etc. were incorporated as added-on, built-in parts of an electronic organ, sold by The Wurlitzer Company under the trademark "Ssh-boom." This latter device is disclosed and claimed in Joseph H. Hearne application Ser. No. 341,080, now Pat. No. 3,317,649, filed Jan. 29, 1964, for "Manual Control of Electronic Percussion Generated With Organ," allowed on Dec. 16, 1966, and in Harold O. Schwartz and Peter E. Maher application Ser. No. 448,362, now Pat. No. 3,340,344, filed Apr. 15, 1965 for Transistorized Electronic Percussion Generator With Organ.

The present invention is concerned with a built-in electronic percussion generator forming a part of an electronic organ, generally similar to that just outlined. It is an object of the present invention to provide improved means for keying or gating the various percussion sound oscillations.

It is a further object of the present invention to provide improved means for modulating a hissing sound to simulate the shimmer of a cymbal.

It is another object of the present invention to produce a built-in percussion accompaniment better adapted for

mass production and requiring less in the way of selected components.

Still another object of the present invention is to provide switching or gating means in percussion generator circuits in an electronic organ which operate more rapidly than in the past.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of an organ constructed in accordance with the present invention;

FIG. 2 is a block diagram corresponding to certain parts of the present invention;

FIG. 3*a* is a partial wiring diagram of the improved percussion generator circuits; and

FIG. 3*b* comprises the remainder of the percussion circuit wiring diagram, and is to be considered in conjunction with FIG. 3*a*.

Turning now in greater particularity to the drawings, and first to FIG. 1, there will be seen an electronic organ generally designated by the numeral **10** and including an upper keyboard or manual **12**, and a lower keyboard or manual **14**, along with a plurality of stop tablets **16**. The organ also includes a pedalboard or clavier **17**, a loudspeaker system **18** which may be complex (as is known in the art), and a swell pedal **20** for controlling the overall volume of the organ.

The electronic circuits of the organ are indicated schematically in FIG. 2, and include a plurality of organ tone generators **22**. These organ tone generators may be of any well-known type, including transistor oscillators. The generators preferably are of the constantly oscillating type, and are respectively connected to key switches **24** operated by the keys for pedals of the keyboards **12** and **14** and the pedalboard **17** to stop switches and filters indicated collectively at **26**, these stop switches being operated by the stop tablets **16**. Connection is then made through a preamplifier **28** to an organ amplifier **30**, and hence to the loudspeaker **18**, which, as indicated previously, can be rather complex in nature.

The organ circuits also include a noise generator and amplifier, indicated generally at **32**. This is connected through a diode **34** to a junction point **36**. The junction is connected through a diode **38** to a junction **40**, and on through a capacitor **42** to a junction **44**. A brush keyer **46** is connected through a resistor **48** to the junction **40**.

Connection is made from the junction **36** through a diode **50** to a junction **52**, and from thence through a capacitor **54** to the junction **44**. A cymbal keyer **56** is connected through a resistor **58** to the junction **52**.

Connection is made from the junction **44** through a junction **60** to noise output amplifier and filter **62**. A shimmer generator **64** is connected through a resistor **66** to the junction **60**. The noise output amplifier and filter **62** is connected to the amplifier **30** through a resistor **68**.

A drum generator **70** also is connected to the amplifier **30** through a resistor **62**, and is under the control of a drum keyer **74**.

A brief functional description of operation is believed in order at this point to facilitate understanding of the complete wiring diagram to follow hereinafter. Thus, each time one of the key switches **24** of a keyboard **12** or **14** is operated to produce an appropriate musical melody tone, the cymbal keyer **56** or brush keyer **46**, or both, depending on the setting of appropriate stop tablets **16**, is operated. The diodes **34**, **38** and **50** are normally biased off. As will be appreciated, the diodes **34** and **38** are in series, thereby greatly increasing isolation over a single diode, and likewise the diode **34** is in series with the diode **50**. If the brush keyer **46** is operated, the diodes **38** and **34** are biased on to conduct a noise signal from the noise generator and amplifier **32** to the noise output amplifier and filter **62**. The circuits are such as to simulate the sound of a cymbal that is struck with a brush. On the other hand, if the cymbal keyer **56** is operated, the diode **50**. If the brush keyer **46** is operated, the signal to simulate a cymbal struck as by a drum stick.

An amplified noise signal simply by itself is somewhat of a hissing sound, and therefore is not quite an accurate representation of a cymbal. However, the shimmer generator operates at a frequency just slightly below the audio range, and amplitude modulates the noise signal, thereby to provide a more realistic cymbal sound.

Each time a key switch **24** is closed by depression of a pedal **16**, the drum keyer **74** is operated to cause the drum generator to produce a drum-like sound. In a specific drum circuit to follow hereinafter, the drum generator is a damped oscillator that is normally biased short of oscillation. The drum keyer provides a potential pulse that momentarily biases the generator into oscillation, which oscillation decays rapidly. Obviously, it would be fully equivalent to provide a continuously operating generator for the drum signal, and to open a gate rather suddenly and then to close it in decaying fashion to simulate the drum sound. The pedal switches also are capable of operating the cymbal keyer.

FIGS. 3*a* and 3*b* should be considered, with both disposed horizontally and FIG. 3*b* disposed immediately above FIG. 3*a*. Certain of the wires extend from one figure to another, and these are respectively labeled A through H on both figures. It will be understood that these are continuous, and have been broken only for the sake of placing the drawing on two sheets to make it large enough.

Referring now to the upper left portion of FIG. 3*b*, the keyboards **12** and **14** are partially represented diagrammatically by a broken line rectangle. Included therein is a positive voltage source, indicated at B+ as a supply bus **76**, connected through a resistor **80** to a distribution bus **82** shunted by a filter comprising capacitor **84** and resistor **86**. Collector rods or buses **88** of the upper manual are respectively connected through resistors **90** to a collector **92**. The collector **92** is connected through a resistor **94** to the bus **82**, and it also is connected through a capacitor **96** to a line **98**. A few of the key switches **100** of the upper manual are shown diagrammatically. Each is grounded and is normally spaced out of contact with the adjacent bus **88**. The key switches **100** are selectively closed against their cooperating buses whenever a respective key is depressed.

Similarly, as to the lower manual, there is a collector **102** connected through a resistor **104** to the bus **82**, and also connected through a capacitor **106** to a line **108**. The key switches **110** of the lower manual likewise are grounded, and are normally spaced from, but are engageable with the collector buses or bus rods **112** upon depression of a correponding key, the buses being connected through resistors **114** to the collector **102**.

It will be understood that there is a voltage divider action among the resistor **80**, the resistor **94**, and the various resistors **90**. (Similarly, there is a voltage divider action among resistor **80**, resistor **104**, and resistors **114**.) Thus, whenever one of the switches **100** is closed, the voltage divider action causes the potential on the collector **92** to drop from the B+ potential on the line **76** to some lower value, and thus causes a negative pulse to be transmitted by the capacitor **96**. If one key switch is held down, and another is depressed, then two resistors **90** are connected in parallel, again somewhat dropping the voltage on the collector **92** and sending another negative pulse through the capacitor **96**. These negative pulses are used for keying purposes, as will be brought out shortly hereinafter. As will be understood, the same situation pertains with regard to the key switches **110** of the lower manual **14**.

The line **98** leads from FIG. 3*b* to FIG. 3*a* to a diode **116** paralleled by a resistor **118**. The diode **116** is poled so as to pass negative pulses, but not any possible pulses or disturbances of a positive polarity. The other side of the diode is connected to a stop tablet switch **120** which is operated by one of the stop tablets **16**, specifically the one numbered in FIG. 3*a* as **16–1** and labeled "SSH-BOOM UPPER." The other side of the switch **120** is connected to a collector **122** which leads through a connecting line **124** to the input of the brush keyer **46**. The negative pulse applied at the input to the brush keyer is indicated above the line **124** and to the left of the brush keyer at **126**.

The line **108** also extends from FIG. 3*b* down onto FIG. 3*a* to a switch **128**, this being controlled by one of the stop tablets **16**, specifically numbered as **16–2** and labeled "SSH-BOOM LOWER." This switch is also connected to the line **124**.

The line **122** is connected through a capacitor **130** to a normally open switch **132** which is closed by means of one of the stop tablets **16**, specifically numbered as **16–3** and labeled "SSH-BOOM PEDAL CYMBAL." The other side of the switch **132** is connected to a line **134**. The line **134** is connected through a resistor **136** to a positive voltage source indicated at B+. Connection is made to the line **134** by a normally open switch **140** grounded through a resistor **138**. The switch **140** is arranged to be closed whenever one of the pedals **17** is depressed, and this, for example, can be done by means of a well-known bail which is pivoted whenever any pedal is depressed, whereby to close the switch **140**. Thus, the voltage appearing on the line **134** is dropped any time the switch **140** is closed, thereby causing a negative pulse or spike to be passed by the capacitor **130** to the line **24**. As will be understood, it is normal for the pedal notes to be played only one at a time, and hence it is only necessary to provide one switch **140**.

A second switch **142** is also closed by depression of any pedal **16**, and this switch is connected through a resistor **144** to a positive voltage, but of lower potential than the B+ supply. The switch **142** may be ganged with the switch **140**, and is so shown. The opposite side of the switch **142** leads through a line **146** to a line **148**, and this in turn leads to a stop tablet controlled switch **150** which is ganged with the switch **132** for closure by the stop tablet **16–3**. The other side of the switch **150** is connected to a line **152**, and this line passes through a diode **154** in series with a resistor **156**, shunted to ground by a capacitor **158**, to a line **160**, about which more will be said shortly. However, it will be apparent that with the switch **150** closed, whenever the pedal switch **142** is closed a positive voltage is applied through the diode **154** to the line **160**. This positive voltage is used for keying, as will be brought out shortly.

Attention now should be directed to the upper portion of FIG. 3*b* wherein the brush keyer **46** is shown in detail. The line **124** is connected to the base of a transistor **162**, the base being connected to ground by a resistor **164** paralleled by a capacitor **166**. The transistor is of the n-p-n type, and has the collector thereof connected through a resistor **168** to a positive potential line **170**. The base of this transistor also is connected through a resistor **172** to the line **170**, thereby serving with the resistor **164** as a voltage divider biasing the base. The emitter is connected to ground through a resistor **174** paralleled by a capacitor **176**. The transistor **162** and associated components will be recognized as being an amplifier which amplifies and inverts the pulse **126**.

The collector of the transistor **162** is also connected to the base of a transistor **178**, also of the n-p-n type, and having the collector thereof connected direct to the positive supply line **170**. The emitter is connected to ground through a resistor **180**, and is also connected to a diode **182**. The transistor **178** will be recognized as an emitter follower buffer amplifier, and the output pulse thereof is positive as indicated at **184**, being sharpened and amplified. The diode **182** is poled to pass positive pulses.

The diode **182** is connected to a resistor **186**, the junction between the diode and resistor being shunted to ground by a rather small capacitor **188**. The output side of the resistor **186** also is shunted to ground by a relatively small capacitor **190**, and also is connected to the resistor **48** previously mentioned. The capacitors and resistors just mentioned may not in every instance be necessary, but are desirable in some organs to slow the attack somewhat, and thereby to avoid adverse interaction with a reverberation unit.

The noise generator and amplifier **32** includes an n-p-n transistor **192** having the base thereof grounded, and having the emitter thereof connected through a resistor **194** to a positive voltage supply line **196**. The collector is not connected, and the base and emitter serve as a diode biased to its Zener point to produce a noise output. A dropping resistor **198** connects the positive voltage supply line **196** to the previously mentioned voltage supply line **170**.

The output of the Zener biased transistor **192** is connected through a capacitor **200** to the base of an n-p-n transistor **202**. The collector of this transistor is connected through a resistor **204** to the positive voltage line **170**, and the line **170** is connected to a biasing resistor **206** which is connected to the base of the transistor **202**, and also to a grounded resistor **208**, the resistors **206** and **208** determining the bias of the base. The emitter is connected to a resistor **210** paralleled by a capacitor **212**, and this parallel combination is grounded through a resistor **214**. Ideally, the resistor **214** would not be required, but this resistor is of selected, rather small value to compensate for other tolerances in the circuit to produce the desired output.

As will be appreciated, the transistor **202** and associated circuit elements comprise an amplifier for the noise generated by the Zener-connected transistor **192**, and the output of the transistor stage **202** is taken from the collector, being connected through a capacitor **216** to the base of a following n-p-n transistor **218**. The collector again is connected through a resistor **220** to the voltage supply line **170**, and voltage divider resistors **222** and **224** provide bias for the base, the resistor **224** being shunted by a capacitor **226**. The emitter is grounded through a resistor **228** and parallel capacitor **230**, and the output is connected through a filter **232** comprising a series resistor **234** paralleled by a capacitor **236**, the input side of this parallel combination being shunted to ground by capacitor **238**. The output side is connected to the diode **34**.

The junction point **36** is connected to the diode **34** as previously stated, and is shunted to ground by a capacitor **240**. It is also connected to the diodes **38** and **50** as previously stated, the diode **38** being connected through the capacitor **42** to the junction **44**, with the intermediate junction **40** being grounded through a resistor **242**. Similarly, the intermediate junction **52** is grounded through a resistor **244**, and is connected to the capacitor **54**, as previously noted. The capacitor **54** is connected through a resistor **246** to the base of a transistor **248** forming a part of the noise output amplifier and filter. The collector of this transistor is connected through a resistor **250** to the positive voltage line **170**, while the base is biased by voltage divider resistors **252** and **254** connected between the line **170** and ground. The emitter is grounded by a resistor **256** paralleled by a capacitor **258**.

The output of the transistor amplifier stage employing the transistor **248** is taken from the collector through a capacitor **260** which leads through a resistor **262** to a shunting tank or tuned circuit comprising parallel connected inductance **264** and capacitor **266**. Connection is continued through a series resistor **268** and a shunting capacitor **270** to a junction **272**. The junction **272** is connected through a series resistor **274** and a grounded shunting resistor **276** to the resistor **68** previously mentioned.

Reference now should be made to the shimmer generator **64** at the upper left portion of FIG. 3*a*. Connection is made to the D generator at 294 cycles as indicated at **278**, and this connection goes through a resistor **280** to a junction **282**. Connection also is made at **284** to the adjacent D# generator at 311 cycles per second, and from this connection the resistor **286** leads to the junction **282**. Connection is made from the junction **282** through a capacitor **288** to the base of an n-p-n transistor **290**, the collector of which is connected through a resistor **292** to the positive voltage supply line **170**. The base is connected to ground by a resistor **294**, and the emitter is also connected to ground by a resistor **296**. The transistor is biased off, and the base to emitter section acts as a diode detector. The sum and difference frequencies are detected, and the output of the transistor, taken from the collector, is applied to a roll-off filter to eliminate frequencies of 294 cycles per second and above. The filter includes a shunting capacitor **298**, and a resistor **300** connected to the emitter by a coupling capacitor **302**. The output side of the resistor **300** is shunted to ground by a capacitor **303**, and is also connected through the resistor **66** and a line **304** to the junction **44**. Only the 17-cycle per second difference frequency comes through to the base of the transistor **248**, and this 17-cycle per second frequency amplitude modulates the noise signal applied to the base of the transistor **248**, thereby to produce a shimmering effect simulating a mechanical cymbal.

The drum generator **70** comprises a phase shift oscillator which is biased short of oscillation. It includes an n-p-n transistor **306**, the emitter of which is connected to a junction **308** leading through a resistor **310** and a decoupling filter comprising series resistor **312** and shunting capacitor **314** to the positive voltage supply line **170**. A voltage divider resistor **316** is connected to the top of the resistor **310**, and at the opposite end is connected to the base of the transistor **306**, the base also being connected through another voltage divider resistor **318** to ground. Series capacitors **320** and **322** also are connected in series to the base, and the junction between these two capacitors is grounded through a resistor **324**. The far end of the capacitor **322** is connected through a resistor **326** to a junction **328**, the latter being grounded through a resistor **330**, and also connected to a resistor **332**. The resistor **332** is connected to a junction **334**, grounded through a capacitor **336**, and connected through a diode **338** to a junction **340**, the latter being grounded through a resistor **342** and connected through a capacitor **344** to a line **346**. A feed-back capacitor **348** is connected from the collector of the transistor **306** to the junction between the capacitor **322** and the resistor **326** in a phase shift oscillator connection.

The line **346** is connected to a switch **350** operated by a "SSH-BOOM PEDAL DRUM" stop tablet **16–4**. When this switch **350** is closed, closure of the switch **142** applies positive potential to the line **346**, which passes a positive pulse through the capacitor **344**, and through the diode **338** to bias the phase shift oscillator of the drum generator for oscillation. Since the capacitor **344** passes only a pulse, the bias immediately starts to decay as the capacitor **336** is initially charged and subsequently decays through resistors **332** and **330**, whereby the oscillations decay in the manner of a struck drum. The diode **338** prevents the capacitor **336** from discharging backwards into the source. Diodes **154** and **182** serve similar purposes.

The emitter of the transistor **306** is grounded through a resistor **352** shunted by a capacitor **354**. The junction **308** on the collector is connected through a coupling capacitor **356** and a series resistor **358** to a junction **360** shunted to ground by a capacitor **362**. The junction also is connected to a line **364** which leads to a movable switch contact **368** of a switch **366**. The movable switch contact normally engages a fixed switch contact **370** connected to the junction **372** between series resistors **374** and **376**, the latter of which has the bottom end thereof grounded. The top end of the resistor **374** is connected to a line **378**. Another fixed switch contact **380** engageable by the movable contact **368** is connected direct to the line **378**. The position of the switch contact **368** is determined by one of the stop tablets **16**, namely, a "NORMAL SSH-BOOM VOLUME-FULL" stop tablet **16–5**. The movable contact **368** engages the fixed contact **370** for the normal position, and there is some attenuation through the voltage divider action of the resistors **374** and **376**. With the stop tablet moved to the "FULL" position, the movable contact engages the fixed contact **380**, and there is no attenuation.

There is a second movable contact **382** which is normally engageable with a fixed contact **384**. This fixed contact is connected through a resistor **386** to ground. The movable contact **382** is ganged with the movable contact **368**, and is moved from the fixed contact **384** by movement of the stop tablet **16–5** from its normal to its full position.

The movable contact **382** is connected to a line **388** leading to a junction **390**, and hence to the junction **272** on the output side of the noise output amplifier and filter. Thus, in the normal position of the stop tablet **16–5**, the resistor **386** shunts the output of this noise output amplifier and filter, and with the movable switch contact **382** raised there is no such shunting, thus raising the volume level.

The junction **390** also is connected by a line **392** to a movable switch contact **394** normally engageable with the grounded fixed switch contact **396**. A movable switch contact **398** is ganged with a fixed switch contact **400**, which also is grounded. The movable switch contact **398** is connected to the wire **378**. Both of the movable contacts **394** and **398** are ganged together and are controlled by a "SSH-BOOM OFF-ON" stop tablet **16–6**. With the stop tablet **16–6** in the "OFF" position, the movable contacts **394** and **398** engage their respective fixed grounded contacts, and thereby shunt the drum generator and the noise output amplifier and filter outputs to ground. Conversely, when the stop tablet **16–6** is moved to the "ON" position, the grounding shunt is removed, and the full output of the amplifier is passed.

Various output connections are shown at the upper right corner of FIG. 3*a*. Thus, a line **402** leads from the resistor **68** and goes to the amplifier **30**, preferably through a preamplifier stage to provide an out of phase relationship at a reverberation unit, and thereby to prevent unfavorable reaction thereon. Alternatively, it can, of course, go to an entirely separate amplifier and loudspeaker system.

Similarly the line **388** is connected through a line **404** to a resistor **406** leading to a junction **408**, and onto the amplifier **30**.

In like manner, the line **378** leads to a junction **410** which is connected through a cross-over resistor **412** to the junction **408**. The resistor **410** also is connected through a series resistor **414** leading to the amplifier.

OPERATION

Portions of the operation of the present invention have been set forth heretofore. However, in order to put everything in one place as to operation, and with reference to FIG. 2 and also FIGS. 3*a* and 3*b*, closure of any key switch **100** of the upper manual or of a key switch **110** of the lower manual, with the appropriate stop tablets **16–1** and **16–2** closed, a negative pulse will be transmitted to the brush keyer **46**. This will apply a positive pulse to the junction **40**, and bias both diodes **34** and **38** for conduction momentarily. The noise signal generated by the noise generator amplifier **32** will be passed briefly as somewhat of a hissing sound, but amplitude modulated by the shimmer generator **64**, whereby to produce a momentary cymbal sound, specifically of a cymbal struck lightly with a wire brush.

The upper manual path includes the diode **116**, whereas there is no such diode in the lower manual path. This is not significant relative to the present circuit, but is provided to prevent notes played on the lower manual, with both upper and lower "SSH-BOOM" stop tablets operated, from feeding back to the upper manual to cause false operation of other circuits. The resistor **118** paralleling the diode is to provide for discharge of capacitors when the diode is not conducting.

When any pedal note is played with the stop tablet **16–3**, "SSH-BOOM PEDAL CYMBAL," actuated, a negative pulse again will be transmitted to the brush keyer **46**, to produce the same action as just described. At the same time, a positive potential will be applied to the line **152**, and through the diode **154** to junction **52**, whereby to turn on diodes **50** and **34**. These diodes will remain turned on as long as the pedal is held down. When the pedal is released, the capacitor **158** will discharge through the resistor **156** to provide a decay. Thus, a tone is produced that is similar to a crash cymbal, i.e., a cymbal struck with a drum stick or the like. Also, if the "SSH-BOOM PEDAL DRUM" stop tablet **16–4** is in operating position, playing of a pedal note will apply a potential to the line **346**, which will be in the nature of a pulse through the capacitor **344** and diode **338** to turn on the drum generator **70** in a decaying fashion to produce a thump similar to that of a bass drum.

It will be observed that the brush keyer is quick acting, and therefore produces a brush sound simultaneously with the playing of a musical or melody note. The diode gates for the brush and cymbal are inexpensive and reliable in operation. Using the two diodes in series reduces leakage noise by a factor of at least ten over a transistor gate using a single transistor. Although turning on of one of the diodes **38** or **50** turns on the diode **34**, thereby leaving only one diode to block in the other path, a higher noise level can be tolerated at this time, since it will be masked by the sound being produced.

Although reference has been made heretofore to "brush" and "cymbal," it will be understood that both are sounds as produced by a cymbal, the former as when a cymbal is lightly actuated by a wire brush, and the latter as when a cymbal is struck by a drum stick or the like. Hence the term "cymbal" is used generically in the claims. Similarly, a pedal is a key operated by the foot, and "key" is intended in a generic sense to cover a pedal as well as a manually operated key.

With reference to the shimmer generator **64**, it will be noted that the generation of the shimmer frequency by the detecting of a difference signal and filtering out of the sum frequency eliminates the necessity of a separate tone generator, and in particular eliminates the need for providing some means of frequency stabilization for the shimmer generator.

The specific example of the invention as herein shown and described is by way of example. Various changes in structure may occur to those skilled in the art, and will be understood as forming a part of the present invention insofar as they fall within the spirit and scope of the appended claims.

The invention is claimed as follows:

1. An electronic rhythm percussion accompaniment system comprising a keyboard musical instrument having a plurality of keys, a plurality of key switch means selectively closed thereby, a plurality of music tone generators respectively operated by said keys for playing music, means for generating a wide spectrum of audio frequency electrical noise, diode means connected to said noise generating means, electronic output means connected to said diode means for producing a cymbal type tone upon conduction of said diode means, said diode means being normally biased off, and means connecting said key switch means and said diode means for rendering said diode means conductive upon closure of said key switch means, said diode means comprising two di-

odes forming parallel paths between said noise generating means and said output means, there being separate means connecting key switch means to each of said two diodes for respectively rendering said diodes conductive.

2. A system as set forth in claim 1 and further including a third diode in series with each of said first two diodes and with said noise generating means, and rendered conductive by interaction with either of the first two diodes rendered conductive.

3. A system as set forth in claim 1 wherein the means interconnecting said key switch means and said diode means includes means for delivering a pulse to said diode means to render said diode means only momentarily conductive.

4. A system as set forth in claim 1 wherein the means interconnecting said key switch means and one of said diodes includes means for delivering a pulse only momentarily to render that diode conductive, and the means interconnecting the key switch means and the other diode includes means for rendering the other diode continuously conductive for a predetermined time.

5. A system as set forth in claim 4 wherein said diode means further includes a third diode in series with each of said first two dides and with said noise generating means, said third diode being normally non-conductive and rendered conductive upon conduction of either of said first two diodes.

6. A system as set forth in claim 1 and further including means for providing a low frequency oscillation, and means interconnecting said oscillation providing means and said diode means for amplitude modulating the noise signal passed by said diode means.

7. An electronic rhythm percussion accompaniment system comprising a keyboard musical instrument having a plurality of keys, a plurality of key switch means selectively closed thereby, a plurality of music tone generators respectively operated by said keys for playing music, means for generating a wide spectrum of audio frequency electrical noise, diode means connected to said noise generating means, electronic output means connected to said diode means for producing a cymbal type tone upon conduction of said diode means, said diode means being normally biased off, means connecting said key switch means and said diode means for rendering said diode means conductive upon closure of said key switch means, means for providing a low frequency oscillation, and means interconnecting said oscillation providing means and said diode means for amplitude modulating the noise signal passed by said diode means, the low frequency oscillation providing means comprising a pair of tone generators differing in frequency, a detector circuit connected to both said tone generators for detecting the sum and difference frequency thereof, and filter means for eliminating said two frequencies and the sum frequency and passing only the difference frequency.

8. An electronic organ rhythm percussion accompaniment system comprising an electronic organ having a plurality of keys, a plurality of key switch means selectively closed by said keys, a plurality of organ tone generators respectively controlled by said key switch means for playing music, organ output means including amplifier means connected to said generators and said key switch means for reproducing such music, means for generating a wide spectrum of audio frequency electrical noise, gate means connected to said noise generating means and to said output means for producing a cymbal type tone upon opening of said gate means, said gate means being normally non-conductive, means for comparing the frequencies of two adjacent ones of said organ tone generators, filter means for eliminating all but the difference frequency, means interconnecting said filter means and said gate means for amplitude modulating noise signals passed by said gate means, and means interconnecting said key switch means and said gate means for rendering said gate means conductive upon closure of said key switch means.

9. An electronic organ rhythm percussion accompaniment system as set forth in claim 8 wherein the frequency comparing means includes detecting means for detecting the sum and difference frequencies.

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U.S. Cl: X.R.

84—1.01; 1.27

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,520,984 Dated July 21, 1970

Inventor(s) William V. Machanian

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 58, change "62" to --72--;
Column 3, line 6, cancel the entire line and substitute:
--diodes 50 and 34 are turned on to conduct a noise--
Column 3, line 66, change "thus" to --this--;
Column 9, line 25, change "dides" to --diodes--.

SIGNED AND
SEALED
NOV 3 1970

(SEAL)
Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents