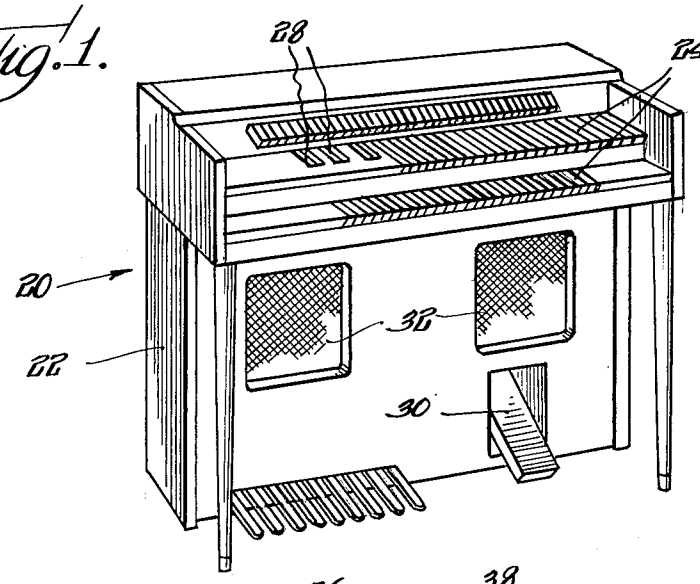
Nov. 3, 1964 H. M. THOMAS ETAL 3,155,760

ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

Filed June 26, 1962 6 Sheets-Sheet 1

Fig. 1.



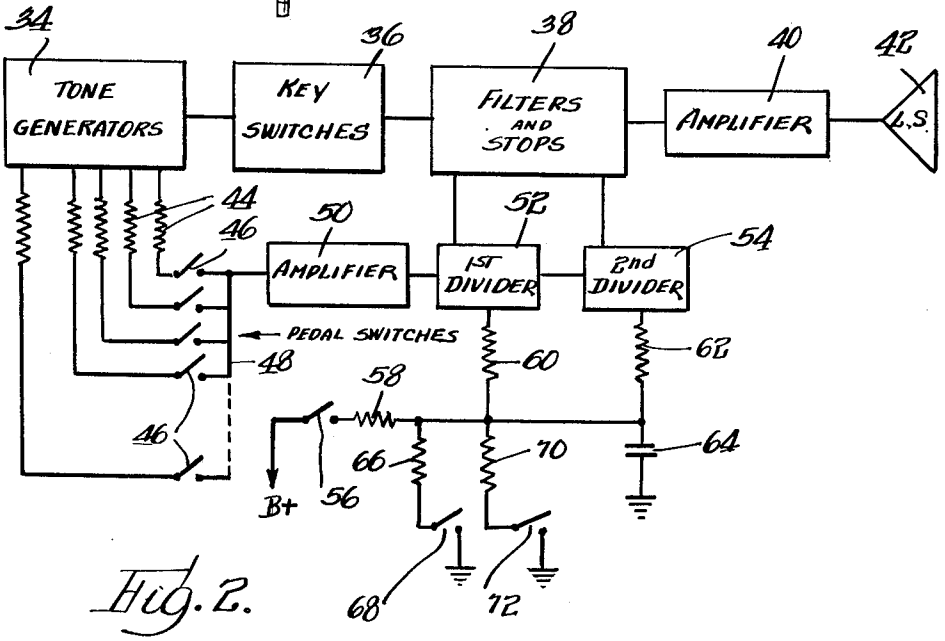


Fig. 2.

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ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

Filed June 26, 1962 6 Sheets-Sheet 2

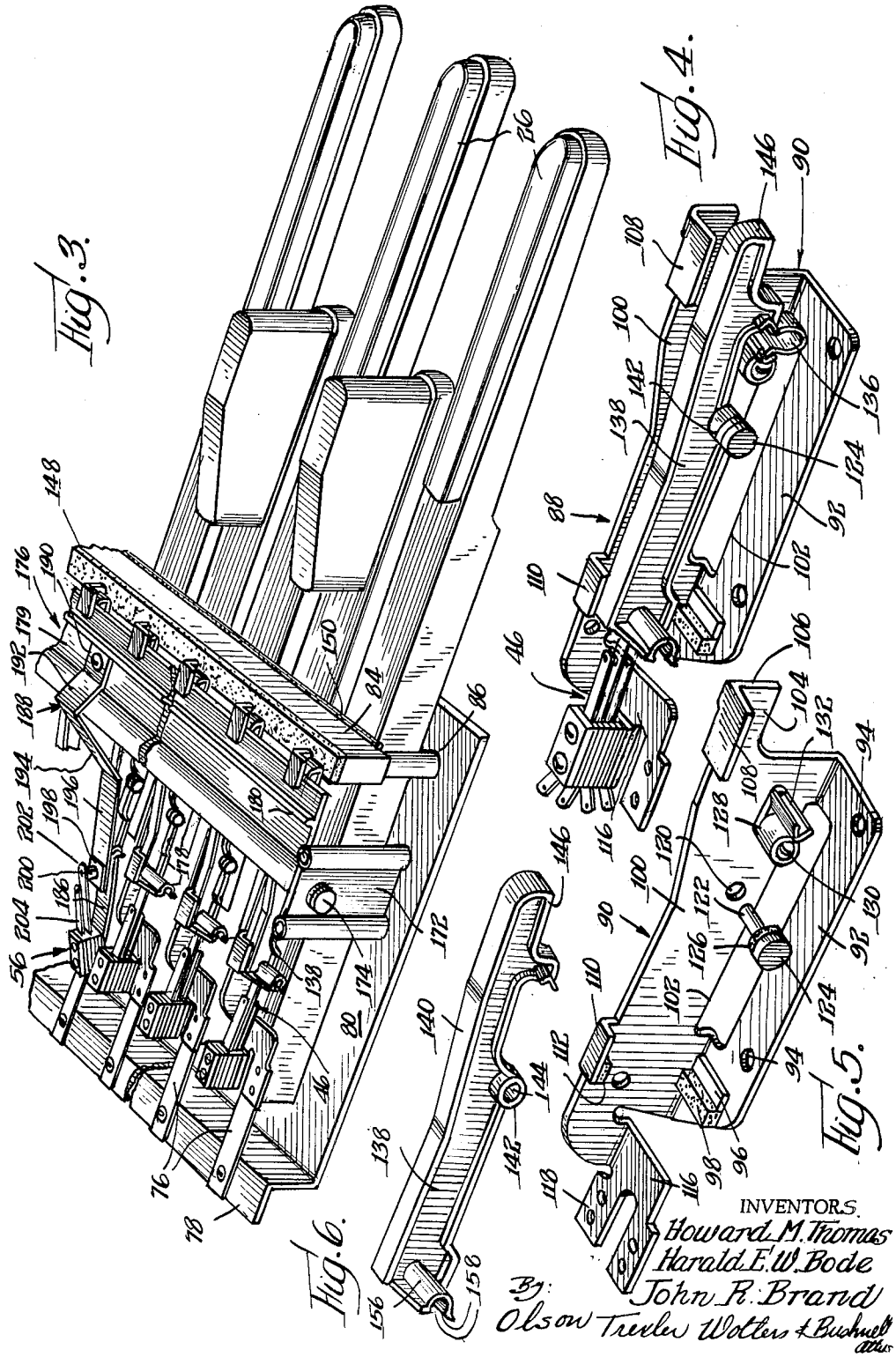


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

Filed June 26, 1962 6 Sheets-Sheet 3

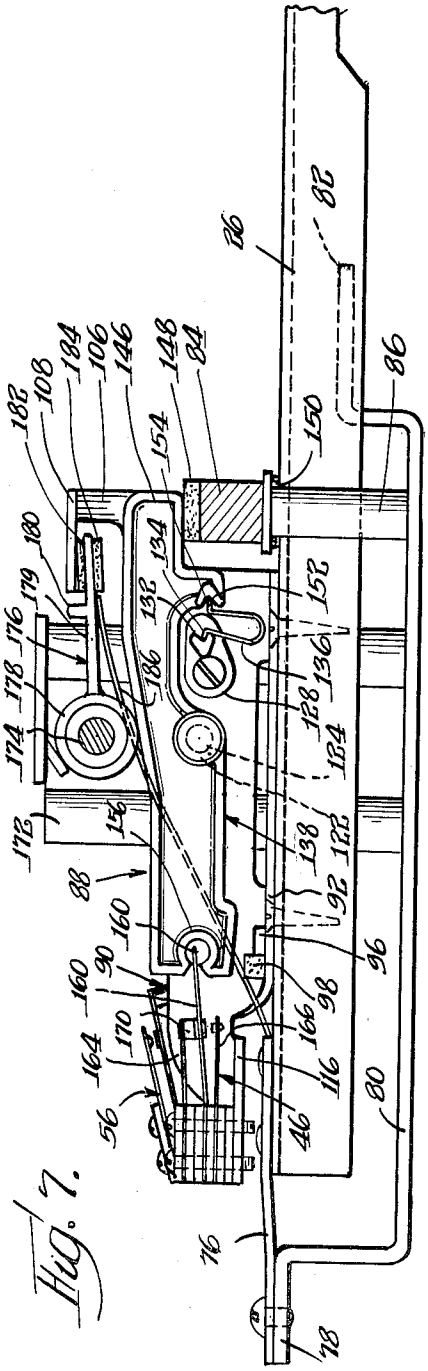


Fig. 7.

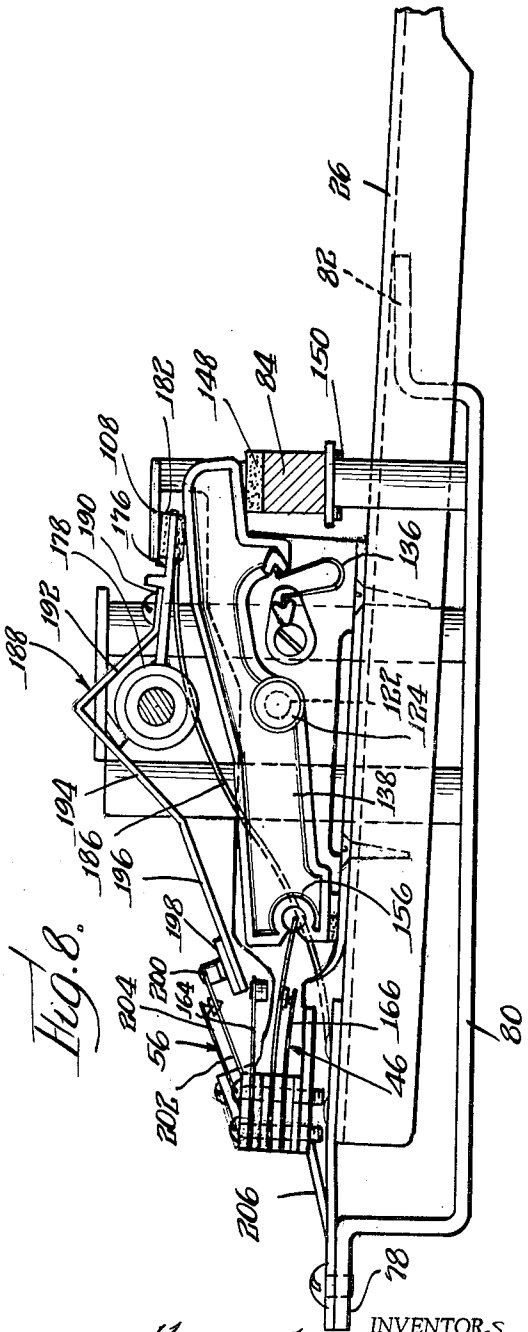


Fig. 8.

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ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

Filed June 26, 1962 6 Sheets-Sheet 4

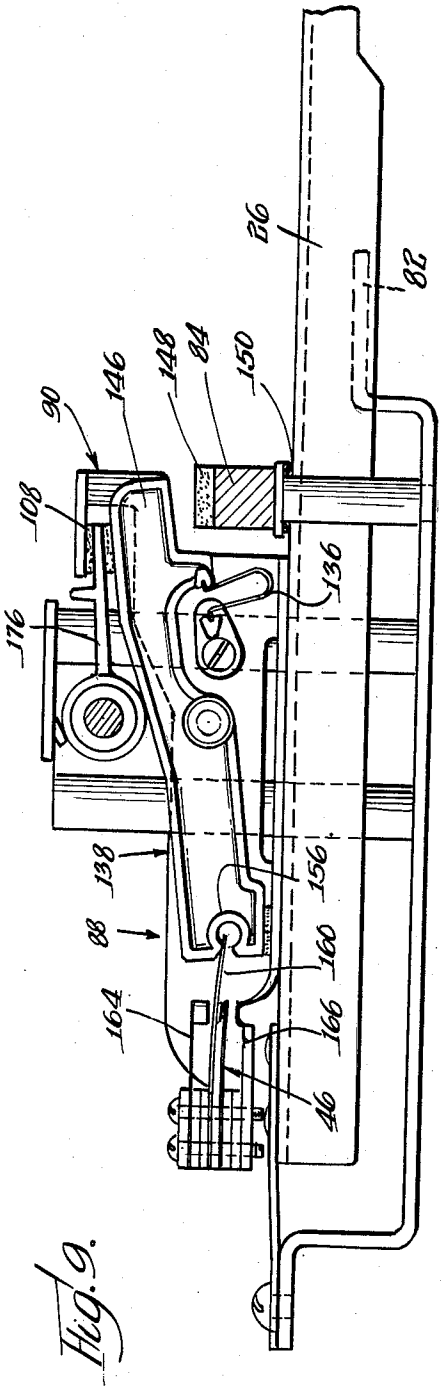


Fig. 9.

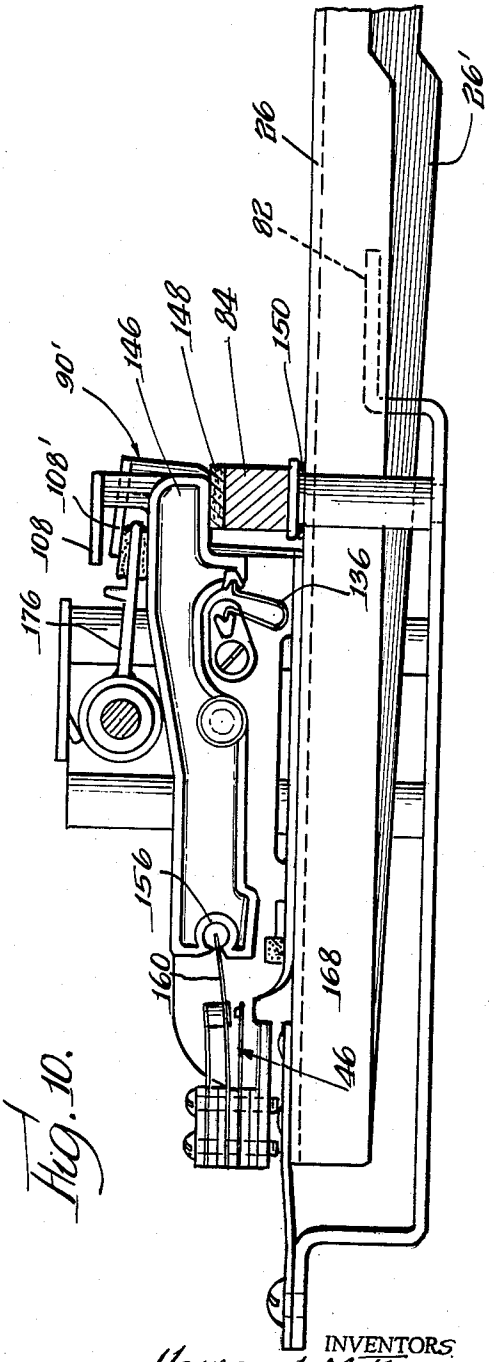


Fig. 10.

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Nov. 3, 1964 H. M. THOMAS ETAL 3,155,760

ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

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Fig. 11.

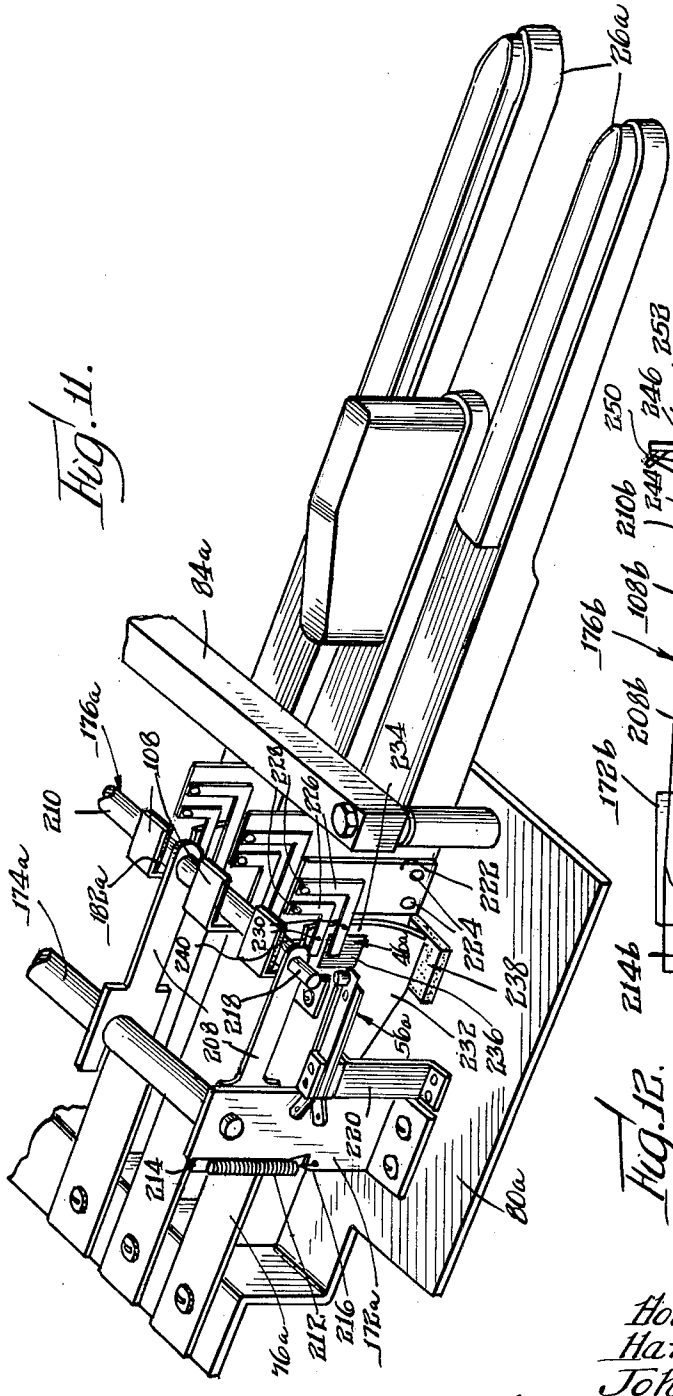
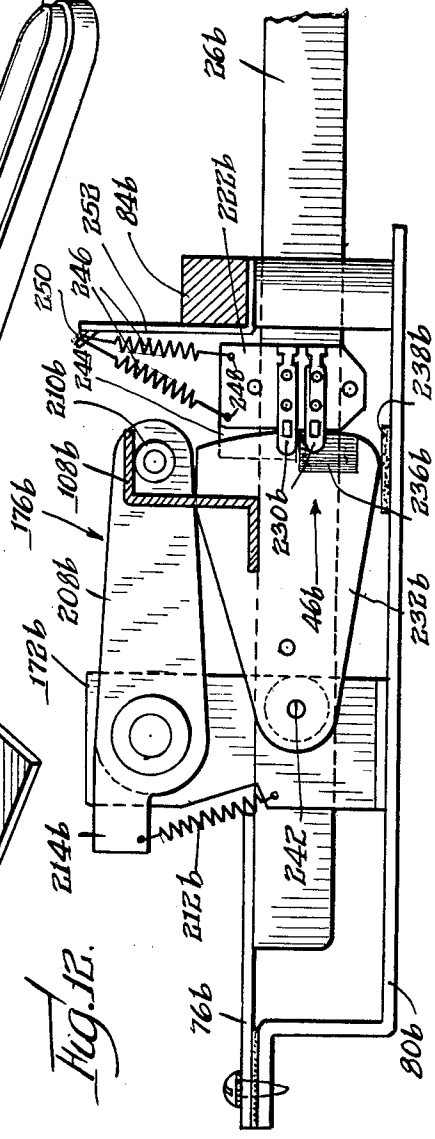


Fig. 12.

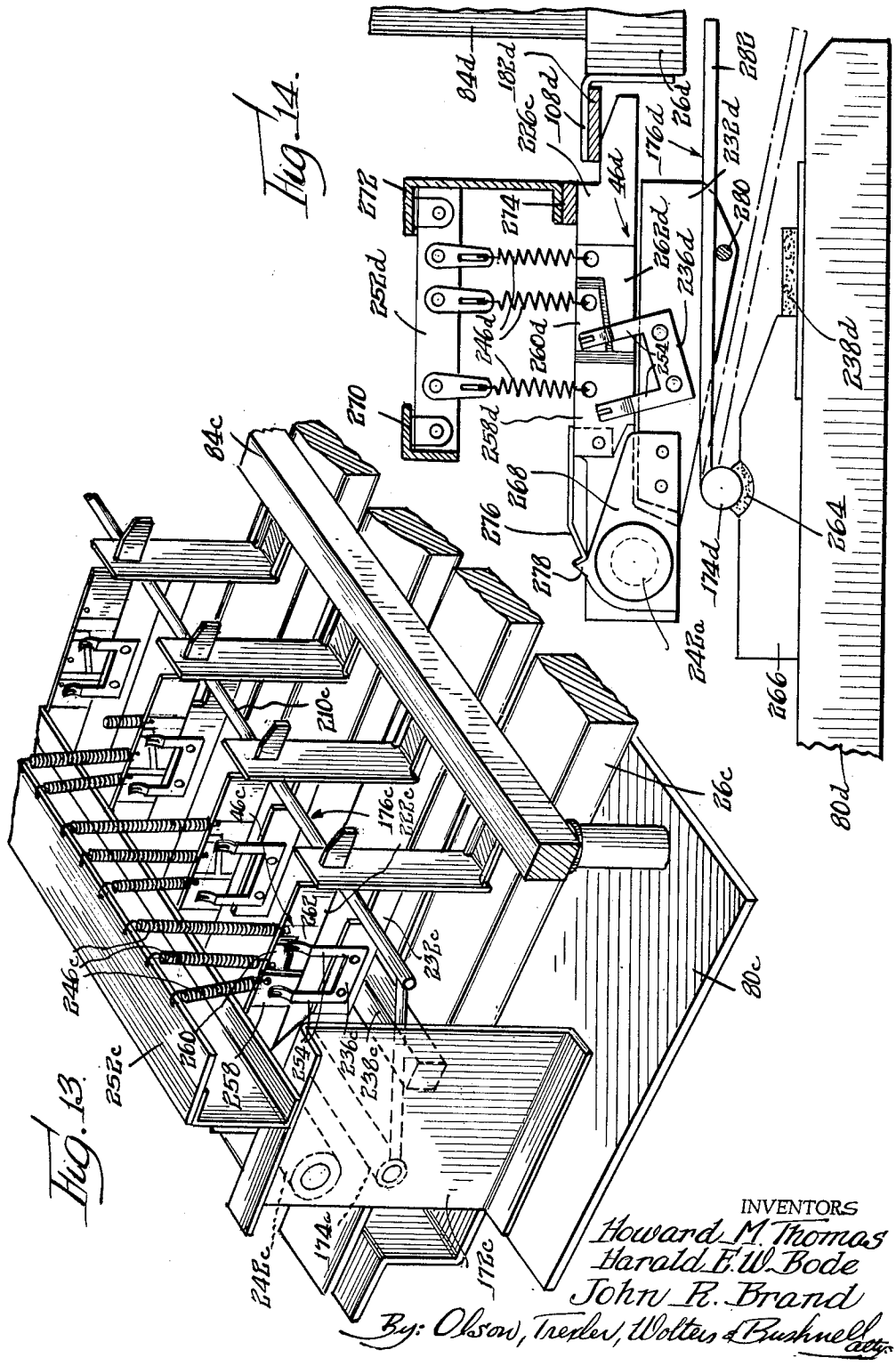


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ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

Filed June 26, 1962 6 Sheets-Sheet 6



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3,155,760

ELECTRONIC MUSICAL INSTRUMENT SWITCH MEANS

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Filed June 26, 1962, Ser. No. 205,377
12 Claims. (Cl. 84—1.01)

This invention relates to the electronic production of music, and particularly with improved pedal switching means for an electronic organ.

As is well known, it is common for electronic organs to have one or two manuals or keyboards, plus a pedal board or clavier. Commonly, the pedals are connected to "borrow" notes from the generators controlled by the manuals, the frequency of such notes often being divided to produce the desired lower tones. Generally speaking, only one pedal tone is played at a time. In fact, it is extremely undesirable to play more than one adjacent pedal tone at a time, since the notes are sufficiently low in frequency that a very bad beat is produced between adjacent, or even nearby notes controlled by the pedal board. Various switching arrangements have heretofore been developed in an effort to insure such one-note-at-a-time playing. However, such systems have often proved troublesome due to the necessity of maintaining critical tolerances or sequences of switch operation.

Accordingly, it is an object of this invention to provide an improved pedal switching arrangement for playing one pedal note at a time in an electronic piano.

It is a further object of this invnetion to provide a pedal clavier in an electronic piano positively insuring that the switch to one note will be open with or before the closing of the switch for another note.

Yet another object of this invention is to provide an improved pedal arrangement for electronic organs wherein the necessary sustain is provided for each pedal note, but wherein each note may be rapidly repeated, if desired.

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 electronic organ incorporating a pedal strutcure constructed in accordance with the principles of the present nvention;

FIG. 2 is a block and schematic diagram of the various parts of the organ;

FIG. 3 is a fragmentary perspective view on a greatly enlarged scale of a portion of the pedal clavier;

FIG. 4 is a perspective view on a greatly enlarged scale of a switch and switch operator as mounted on each pedal and forming a part of the present invention;

FIG. 5 is a perspective view of a portion of the device of FIG. 4 and specifically comprising a mounting bracket;

FIG. 6 is a perspective view of the switch actuator as shown in FIG. 4 and cooperating with the bracket of FIG. 5;

FIG. 7 is a side view of a portion of a pedal and the associated switch and switch operator structure;

FIG. 8 is a view similar to FIG. 7, showing the parts in a different position of operation;

FIG. 9 is a view similar to FIG. 7 and showing the parts in yet another position of operation;

FIG. 10 is another view similar to FIG. 7 and showing the parts in yet a different position of operation;

FIG. 11 is a fragmentary perspective view of a modified pedal clavier;

FIG. 12 is a side view of a portion of a pedal and of associated switch structure similar to that shown in FIG. 11, but modified somewhat therefrom;

FIG. 13 is another fragmentary perspective view showing yet another embodiment of the invention; and

FIG. 14 is a fragmentary side view of a further modification of the invention.

Referring now in greater particularity to the drawings, and first FIG 1, there will be seen an electronic organ, designated generally by the numeral 20, and constructed in accordance with the principles of this invention. The organ 20 includes a cabinet 22. It is provided with a pair of manuals or keyboards 24, and with a pedal clavier 26. Suitable stop tablets 28 are provided controlling which banks of tones are to play, and also to control relative intensities of the notes of the different manuals, and to control vibrato effects. The electronic organ is also provided with a swell pedal 30 for controlling the instantaneous overall volume of the organ. Loudspeakers are provided behind grills 32 in the organ cabinet.

Attention now should be devoted to the block or schematic diagram of FIG. 2, illustrating the electronic aspects of the organ. The organ is provided with a plurality of tone generators 34 of any known or suitable type. Preferably, the organ is of the subtractive type in which complex tones are generated, each of which is replete with harmonics which are selectively filtered to produce the desired tone quality. Further, for purposes of illustration, the tone generators may be electronic tube or transistor oscillators, or they may be wind driven vibratile reeds with capacitive or inductive type pickups.

The tone generators are connected to respective key switches 36. These in turn are connected to the filters and stops for controlling which tones are to be delivered to the amplifier 40, and finally to the loudspeaker 42 for converting the amplified electric oscillations into audible organ tones.

The tone generators 32 serve also to provide the pedal notes. Specifically, the lowest thirteen half-tones are respectively connected to isolating resistors 44 and to pedal switches 46. These pedal switches are connected to a common collector 48 leading to an amplifier 50.

The amplifier 50 is connected to a first divider 52 for dividing the frequency of the tones from the generators 34 to provide tones one octave lower. The first divider is connected to the filters and stops 38, and it also is connected to a second divider 54 for producing tones yet another octave lower. The second divider also is connected to the filters and stops 38. Both of the dividers 52 and 54 are normally inoperative to produce an output, by virtue of a lack of B+ or plate potential applied thereto.

Accordingly, as is indicated on FIG. 2, B+ is provided through a normally open switch 56. This switch is arranged so as to be closed mechanically at the time any of the pedals 26 is depressed to close one of the switches 46, as will be brought out hereinafter. The B+ supply continues from the switch 56 through a resistor 58, and through respective resistors 60 and 62 to the first and second dividers 52 and 54. Provision is made for sustaining the pedal tones comprising a shunting capacitor 64 on the B+ supply line, a shunting resistor 66 and a sustaining switch 68, and another shunting resistor 70 and a short sustaining switch 72.

As will be more apparent in connection with the physical structure hereinafter, whenever a pedal 26 is depressed, the switch 56 is closed, and the respective switch 46 is closed. Thus, a stable tone from the tone generators 34 is supplied through the amplifier 50 to the first and second dividers 52 and 54. Which of these two dividers will play is determined by the setting of the stops and the co-action with filters as determined by the stop tablets 28. Subtantially concurrently with the closing of one of these switches 46, the switch 56

closes to provide the B+ potential to the dividers, whereby to cause them to operate. When the pedal 26 is released, the corresponding switch 46 remains closed, whereby to provide the stable tone to the dividers. However, the switch 56 opens, and the output of the dividers continues for a short period, determined by the setting of the switches 68 and 72. If the same pedal is again depressed, the corresponding switch 46 remains closed, and the switch 56 is re-closed, again to provide B+ potential to the dividers 52 and 54. If a different pedal is depressed, the first switch 46 is opened, and the respective switch corresponding to the newly depressed pedal is closed. Simultaneously, the switch 56 is re-closed. Accordingly, a different tone is produced. The structure for opening one switch 46 upon the closing of another switch 46 will be set forth immediately hereinafter.

Reference now should be had to FIGS. 3–7 for a description of the pedal, switch and switch operating structure. Thus, the pedals 26, which are generally of conventional design, are pivotally mounted by means of flexure springs 76 secured as by rivets to the upper horizontal flange 78 of a sheet metal pan 80, which is suitably secured within the organ cabinet 22. The flexure springs 76 may also be riveted to the pedals. The pan 80 near the front edge thereof has raised horizontal flanges 82 received within the pedals, both to stabilize the pedals laterally, and to serve as downstops for the pedals. A common upstop is provided by the pedals in the form of a rail 84 supported on posts 86 which upstand from the pan 80. The rail 84 extends across the tops of all of the pedals.

Each pedal 26 has mounted on the top thereof, and near the pivot end, within the organ cabinet, a switch operator designated generally by the numeral 88. Each such operator includes a sheet metal bracket 90, best seen in FIG. 5. All of the switch operators are of identical construction, and a description of one serves for all. Thus, continuing primarily with FIG. 5, each bracket 90 includes a horizontal base flange 92 having near the opposite ends thereof a pair of apertures 94 through which pass screws threaded into the tops of the pedals for mounting the brackets 90. Each base flange 92 has near the rear or inner end thereof, a thin pad of material of limited resiliency, such as neoprene, such pad being identified by the numeral 96, and adjacent pad 98 of greater height, and much greater compliance. For example the pad 98 may be made of polyurethane. As will be brought out hereinafter, the pad 98 serves to decelerate a member while the pad 96 serves as a final resilient stop.

A vertical, upstanding flange 100 is integral with the horizontal base flange 92 along a longitudinal edge thereof, and a cutout 102 is provided at the junction of the two flanges to facilitate the forming of the bracket 90. The vertical flange is provided at its front or outer end with an extending finger 104 disposed substantially parallel to the pedal 26 and having an upward extension 106 from which an overlying horizontal flange 108 projects back over the base flange 92. The flange 108 lies on the same side of the vertical flange 100 as does the base flange 92.

Along the top of the vertical flange 100, and toward the back or inner end thereof at a lower level than the flange 108, there is provided a horizontal flange 110. A small pad 112, as of neoprene, is provided beneath the rear portion of this flange. Arearward extension 114 of the vertical flange supports a bifurcated horizontal flange 116 at an intermediate level above the base flange 92. The switch 46 is supported on one of the bifurcations 118 of the flange 116. In the illustrative embodiment, this is the bifurcation adjacent the vertical flange 100. If additional switch functions are to be operated by the pedals, a like switch can be mounted on the other bifurcation. The switch 46 simply can comprise a single movable contact and a single fixed contact, in line with the schematic showing of FIG. 2. However, as will be brought out presently, in accordance with a modification of the invention, there may be a single movable contact in combination with a pair of fixed contacts.

Somewhat toward the front end of the vertical flange 100, and generally midway from the top to bottom, there is provided an aperture 120 for receipt of a pivot pin 122, having an enlarged head 124 with a felt washer 126 beneath it. This pin is for the pivotal mounting of a switch actuator shortly to be described.

Forwardly of the pin 122, a plastic spring anchor 128 is mounted on the side of the vertical flange 100 by means of a screw 130 passing through the spring base or anchor 128 and threaded into the flange 100. The anchor or base 128 is provided on its back side with a projection received in an aperture (not shown) in the flange 100 positively to position the spring base 128 in co-action with the screw 130. The spring base is provided with a V-shaped channel or trough 132 for receipt of one laterally extending end 134 (FIG. 7) of a hairpin shaped spring 136, operating as an overcenter spring, as hereinafter set forth.

A switch actuator 138 is formed of molded plastic and is provided with a peripheral reinforcing flange 140. The switch actuator is of an elongated nature, and has near its midpoint a hub 142 extending in both directions from the plane of the web from which the flange 140 extends. The hub 142 is provided with a central bore 144 receiving the pin 122 for mounting the actuator on the bracket 90.

The actuator 138 is of substantially equal length on opposite sides of the hub 142, and is provided with a raised heel 146 normally resting on a felt pad 148 on top of the rail 84. A similar pad 150 is provided beneath the rail and engageable with the pedals 26 in limiting their upward movement. As will be apparent, the felt pads hold noise at a minimum.

Spaced in from the heel 146 toward the pivot as provided by the hub 142 and bore 144 on the pin 122, there is a V-shaped trough 152 receiving the opposite end flange 154 of the hairpin spring 136. The hairpin spring acts as an overcenter spring with the center points comprising the pivot pin 122, the spring base or trough 132, and the spring base or trough 152. The spring 136 preferably is made of sheet metal, and may, for example, be of spring steel or phosphor bonds.

At its opposite end, the actuator 138 is provided with transverse projection 156 substantially parallel to the bore 144, and having a substantially cylindrical bore therethrough opening along an element thereof for reception of the movable arm of the switch 46. The opening provides opposed, substantially knife edges 158. The projection 156 is sufficiently long that the movable arms of two switches respectively mounted on the bifurcations of the flange 116 may be simultaneously operated although only one such switch is shown. A transverse wall 160 (parallel to the web of the actuator 138) divides the projection 156, whereby to insure electrical isolation between two switch arms, and also to provide mechanical strength.

The details of one of the switches 46 may be seen in FIG. 7. This switch includes a movable switch arm 160 having an extending end received between the knife edges 158 of the projection 160. Contact means 162 are mounted on opposite faces of the switch arm 160. The upper of these two contact means engages a complementary contact on a fixed switch arm 164, while a lower is engageable with a contact on a second fixed switch arm 166. With the parts in the normal rest position as shown in FIG. 7, the contacts 162 of the movable switch arm are spaced from the lower fixed contact 168, and are in engagement with the upper fixed contact 170. The contacts 162 and 168 are all that are represented in FIG. 2, and for purposes of FIG. 2, the upper switch arm 164

and contact 170 could be omitted. Alternatively, as a modification thereof, this upper contact and switch arm may be included, as shown in FIGS. 3–7. For purposes of completing a disclosure relative to this upper switch arm, it will be apparent that this upper switch arm could be grounded, whereby to prevent any spurious signal coming through from the tone generators 34. Alternatively, the upper and lower fixed switch arms could be arranged in any known or suitable preference circuit to prevent more than one note from playing at any given time, even though more than one switch may be operative. The switch arms are insulated from one another by conventional insulators, and are secured to the bifurcated flange 116 by screws, which may also hold the insulating members and switch arms together, all in accordance with conventional practice.

Considering now particularly FIGS. 3 and 7, a pair of brackets 172 are respectively mounted on the sheet metal pan 80 on opposite sides of the group of pedals 26. A pivot rod 174 extends between the brackets 172, overlying the pedals and the switch operators 88. The pivot rod 174 preferably is pivotally received in suitable bushings in the brackets 172, and forms a mounting means for a bail designated generally by the numeral 176. The bail conveniently is made of extruded aluminum, and includes a cylindrical portion 178 fitting over the pivot rod 174, and a flange or plate 179 integral therewith and extending forwardly above the operator heels 146 and beneath the flanges 108 of the mounting brackets 90. The flange or plate 179 of the bail is provided with an integral stiffening rib 180 extending from end to end thereof. A felt strip or pad 182 lies along the upper, outer edge of the bail plate 179 for engagement by the bracket flanges 108 to insure quiet operation. A similar strip or pad 184 of felt may lie beneath the plate adjacent the outer edge thereof, for engagement with the operator heels 146.

The bail is normally pivoted to its upper limit position as illustrated in FIG. 7 by means of a plurality of leaf or blade type springs 186 supported from the flange 78 of the pan 80 and cantilevered out beneath the plate 179 of the bail 176. Besides biasing the bail up to its normal upper limit position, the springs 186 provide a certain amount of support for the bail intermediate to brackets 172, whereby no brackets or other supports are necessary for the bail intermediate the ends thereof.

As shown in FIGS. 3 and 8, the bail is provided with a switch operating arm or lever 188 having a front flange or foot 190 secured to the bail plate 179 by means such as a screw. The arm 188 extends diagonally up at 192 from the bail plate, and then down at 194, clearing the cylindrical portion 178 of the bail, and finally out at 196 beneath the switch 56. A felt or other insulating pad 198, such as of neoprene, is provided on the outer end of the arm for engagement with the block 200 on the end of the movable arm 202 of the switch 56. The contact on the movable arm 202 normally is spaced from the contact on the fixed arm 204, but is brought into engagement therewith when the bail is pivoted in a clockwise direction. The switch 56 is mounted in a tipped-up position on a bracket 206 fixed to the flange 78 of the pan 80.

Operation of the foregoing structure will now be set forth, with particular reference to FIGS. 7–9. Several parts have been omitted from FIGS. 9 and 10 for clarity of illustration, as will be apparent. The parts are shown in their normal or switch off position in FIG. 7. When the pedal 26 is depressed by the organist's foot the bracket 90 is carried down with the pedal. However, the heel 146 of the corresponding switch actuator 138 is resting on the felt strip 148 on top of the rail 84, and hence cannot lower. Accordingly, the switch operator 138 pivots about its mounting pin 122 to the position shown in FIG. 8, thus lowering the switch arm 160 to bring the lower contact 162 thereon into engagement with the contact 168 on the lower switch arm 166, at the same time breaking contact with the upper switch arm.

The flange 108 necessarily lowers with the bracket 90. Since it is engaged by the felt strip 182 on the underside of the bail 176, the bail is pivoted in a clockwise direction. This causes the left end of the bracket 138 to rise up beneath the movable arm 202 of the switch 56, whereby to close the switch substantially simultaneously with closure of the switch 46. Thus, a particular pedal organ tone is selected, and the corresponding divider is energized to pass the tone. When the pedal is released, the bail pivots in a counter-clockwise position, since the flange 108 rises with the pedal, whereby to open the switch 56. However, the spring anchors or troughs 132 and 152 have passed a dead center position relative to the pivot pin 124. Accordingly, the hairpin spring 136 prevents the switch actuator 138 from pivoting back to its normal position.

Accordingly, the heel 146 raises up off the rail pad 148, as seen in FIG. 9. The overcenter position of the switch actuator 138 causes the actuator to hold the arm 160 of the switch 46 in its lowered, closed position. Thus, the selected tone oscillation continues to be applied to the dividers. However, the B+ to the dividers diminishes once the switch 56 is opened, and the sustaining capacitor starts to discharge into the dividers, or through the sustain resistors. Thus, a normal pedal organ tone is produced with an organ-like decay period. As otherwise would be the case, the oscillations would be cut off immediately if the overcenter switch actuator did not hold the switch in actuated position.

Subsequently, when another pedal is depressed as shown in the background of FIG. 10 at 26′, the bracket 90′ associated therewith is pulled down so that the flange 108′ thereof presses down on the switch actuator 138 which has its heel 146 tipped up into the air. The flange 108′ thus returns such switch actuator to its normal, switch off position of FIG. 7. The parts are dimensioned so that the previously tipped switch actuator opens its switch 46 just before the next switch 46 is closed by the switch actuator on the pedal subsequently depressed, as the pedal 26′. It does not make any difference what switch actuator might previously be tipped up in the air, hence any and all of the flanges 108 engage the bail upon depression of a pedal whereby to pivot the bail in a clockwise direction and return any tipped switch actuator to normal, switch off position.

A modification of the invention is shown in FIG. 11. Many of the parts are similar to those heretofore described, and similar numerals are utilized, with the addition of the suffix *a*. The bail 176*a* is of somewhat different construction than that previously disclosed, comprising a plurality of forwardly extending arms 208 pivotally mounted on a pivot rod 174*a*, and carrying at their outer end a transverse rod or bight 210. A substantially Z-shaped bracket upstands from each key and has a top flange 108*a* overlying the bight 210, for pivoting the bail down against the action of a helical spring 212 stretched between a tail 214 on one of the arms 208 and a spring anchor hole 216 on the bail mounting bracket 172*a*. The bight 210 has a leftward projection 218 arranged to close the switch 56*a*, which is mounted on an upstanding bracket 220 from the pan 80*a*.

Each switch 46*a* is structurally rather substantially different from the switches 46 previously disclosed. Each such switch 46*a* includes a fiberboard 222 secured on the side of a pedal 26*a* inwardly of the upstop 84*a*, by any suitable means, such as screws or rivets 224. Near the upper edge, there is provided a pair of L-shaped metal members 226, conveniently secured to the board by means of eyelets 228, which also serve as electrical terminals. The bases or transverse members 230 of the L-shaped metal members 226 extend beyond the edge of the corresponding fiberboard 222.

A fiber member 232, hereinafter referred to as a "butterfly," is pivoted (not shown) on each pedal 26*a*.

Each of the fiber butterflies 232 is provided with an upstanding portion 234 carrying a metal or other conductive plate or the like 236 normally engaged by the lower of the two transverse arms 230. A felt strip 238 underlies all of the butterflies 232 to limit the lower positions thereof.

When any pedal 26*a* is depressed, it lowers the two transverse bases 230 of the L-shaped members 226 so that both engage the conductive member or plate 236, which thereby acts as a shorting bar. When the pedal is released by the organist's foot, the L-shaped members 226 frictionally pick up the butterfly 232, thereby retaining the shorting bar 236 in electrical engagement across the transverse members 230. Subsequently, when another pedal is depressed, the bracket flange 108 thereon lowers the bight 210 of the bail 176*a*. This bight engages an upstanding portion 240 of the previously raised butterfly, which portion extends above the metal plate 236 ,whereby to depress the butterfly, and to open the connection made thereby. As will be obvious, the projection 218 of the bight 210 closes the switch 56*a* whenever any pedal is depressed. As in the previous form of the invention, the switch remains closed without the necessity of introducing any extraneous parts into the switch positively to latch it closed.

A modification of the invention is shown in FIG. 12 which is quite similar to the embodiment of FIG. 11. The conductive patch or plate 236*b* on the butterfly 232*b* is somewhat lower than in FIG. 11, and the pivot for the butterfly is indicated at 242. Generally, the parts are similar to those heretofore shown and described, and similar numerals are used with the addition of the suffix *b*. The fiberboard 222*b* carries a pair of transverse projecting contacts 230*b* at a lower elevation for frictional and electrical engagement with the patch 236*b*. In addition, there is a projection which may be metallic or otherwise, indicated at 244, extending toward the butterfly from beneath the fiberboard 222*b*. In other words, the projection 244 lies between the fiberboard and the pedal 26*b*, whereby the projection 244 and the transverse contacts 230*b* actually grip the butterfly between them, thereby to enhance the frictional picking up thereof with less chance of malfunctioning due to wear of the parts.

Helical springs 246 extend from openings 248 adjacent the top of the fiberboard 222*b* to terminals 250 at the top of a terminal board 252 carried by the upstop rail 84*b*. The springs therefore may be used to make electrical contact to the transverse contacts 230*b* from the terminals 250.

A further embodiment of the invention involving frictional picking up of a butterfly contact is shown in FIG. 13. Many of the parts are similar to those heretofore shown and described, and similar numerals are used with the addition of the suffix *c*. In this instance, each switch 46*c* comprises a butterfly 232*c* pivoted on a transverse rod 242*c*. The butterfly is provided with a shorting bar 236*c* having a pair of upstanding arms 254 thereon. Another insulating member 222*c* is pivotally supported on the rod 242*c*, the butterfly 232*c* have a slight offset therein to accommodate for this. The front end of the insulating member 222*c* is received in a slot in an upstanding bracket 256 affixed to the top of the respective pedal 26*c*. This insulating member 222*c* carries three contact patches, respectively 258, 260, and 262. The patch 258 comprises a common contact, and is secured to one of the terminals of the terminal board 252*c* by one of the springs 246*c*. It is always engaged by one of the arms 254. The other arm 254 in the initial position engages the patch 262. When any pedal 26*c* is lowered, the bracket 256 thereon pulls down the insulating member 222*c*, and hence lowers the contact or patch 260 into engagement with the arm 254, the same arm 254 immediately therebefore leaving the patch 262. The patches 258, 260 and 262 are individually connected by the springs 246*c* to terminals on the board 256*c*. When the pedal is released, the arms 254 are frictionally held by the patches 258 and 260, whereby the butterfly 232*c* is raised, and the circuit remains closed between the patches 258 and 260. As will be appreciated, a backing up member can be provided opposite the arm 254, similar to the disclosure in FIG. 12. Subsequently, when some pedal 26*c* is depressed, the bail 176*c* is pulled down by engagement of the respective insulated member 226*c* thereagainst, whereupon the bight 210*c* of the bail lowers the previously raised butterfly 232*c*, thereby to move the rightmost arm 254 into engagement with the respective contact 262. The switch therefore comprises a single-pole, double-throw switch. Although the common switch operated by the bail is not shown in FIG. 13, and is also omitted from FIGS. 12 and 14, it will be understood that such switch is supplied.

Still another frictional pickup type of switch arrangement is shown in FIG. 14, for example, with printed circuit boards. A wood base member 80*d* is substituted for the sheet metal pan 80 heretofore used, and the bail 176*d* pivots about a rod 174*d*, resting on a felt cushion 264 in a concave groove across a wood block 266.

Each switch 46*d* comprises a butterfly 232*d* having a shorting bar 236*d* thereon with a pair of upstanding arms 254*d*. As will be appreciated, there could be a backing-up bar or pressure member on the opposite side of the butterfly 232*d*, as disclosed in connection with FIG. 12. Each butterfly 232*d* is fixed to a pivot member 268, pivoted about a transverse rod 242*a*.

In addition, there is an insulating member 222*c* having three conductive patches thereon, respectively numbered 258*d*, 260*d* and 262*d*. The parts are shown in FIG. 14 in the tone playing position in which the butterfly 232*d* shown has been picked up.

A plurality of helical springs 246*d* connects the conductive patches respectively to terminals on terminal boards 252*d*, fixedly supported by brackets from transverse frame members 270 and 272. A strip of felt 274 runs along the underside of the frame member 272 and serves as an upstop for the pivoted insulating member 226*c*.

A spring 276 is provided on each pivoted insulating member 226*c*, and this spring cooperates with a projection 278 on the respective pivoted member 268, thereby forming a detent mechanism. Normally, each butterfly 232*d* is down, and the end of the corresponding spring 276 lies to the left of the corresponding projection 278, as shown in the drawings. When a pedal 26*d* is depressed, the bracket 108*d* and underlying felt 182*d* thereon depresses the corresponding insulating member 226*c*. This moves the patch 260*d* into engagement with the corresponding arm 254, and upon release of the pedal, the member 226*c* picks up the butterfly 232*d*, frictionally, and with the aid of the detent 276, 278. Each butterfly is provided with a transverse projection or stud 280, and the bail is of a more or less comb-like configuration, having radial arms or elements 282 respectively engageable with the studs 280, whereby to lower any raised butterfly upon depression of a pedal 26*d*, and consequent engagement thereof with the bight of the bail.

It will be appreciated that in embodiments of the invention using the friction pickup, it is the resiliency of the contact engagement that caused the contacts and the shorting bar to remain in engagement. The resiliency of the overcenter springs is obvious. Thus, in all embodiments of the invention, resiilency is of importance in maintaining the contacts in engagement. Stated another way, the contacts are impositively held in engagement.

In the ensuing claims, the word "digital" is used to cover pedals or keys of an electronic organ or other electronic musical instrument.

The specific examples of the invention as herein shown and described are for illustrative purposes only. Various changes no doubt will occur to those skilled in the art, and will be understood as forming a part of the present in-

vention insofar as they fall within the spirit and scope of the appended claims.

The invention is claimed as follows:

1. An electronic musical instrument comprising means for providing electric oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means, connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, and a plurality of switches respectively operated by said digitals and respectively interconnected with said oscillation providing means and said amplifier for rendernig said tones respectively audible, each of said switches comprising at least two contacts, and mechanical means for bringing said two contacts into electrical engagement, said mechanical means remaining in contact engaging position indefinitely, and common means operable by any of a plurality of digitals and operative upon any of said mechanical means in contact engaging position to move said contacts out of electrical engagement upon manipulation of any of said digitals.

2. An electronic musical instrument comprising means for providing electric oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, a plurality of switches respectively operable by said digitals, and respectively interconnected with said oscillation providing means and said amplifier for rendering said tones respectively audible, each of said switches comprising at least two contacts and mechanical means for bringing said contacts into electrical engagement, resilient means for thereafter holding said mechanical means in contact engaging position, and common means operable by any other plurality of digitals, and operative upon any of said mechanical means in contact engaging position, to move said two contacts out of electrical engagement upon manipulation of any of said digitals.

3. An electronic musical instrument as set forth in claim 2, wherein the resilient means comprises overcenter spring means.

4. An electronic musical instrument as set forth in claim 2, wherein the resilient means comprises resilient, frictionally engageable electric contact means.

5. An electronic musical instrument comprising means for generating electric oscillations corresponding to a plurality of different tones, amplifier means for amplifying said oscillations, and electro-acoustic transducing means connected to said amplifier means for converting the amplified oscillations into audible musical tones, electronic divider means for providing electric oscillations of a lower frequency and connected to said amplifier means, a plurality of pedals operable by the feet of a musician, and a plurality of switches respectively operable by said pedals and respectively interconnecting said oscillation generators to said amplifier means for rendering said tones respectively audible at lower frequencies, each of said switches comprising at least two contacts and mechanical means for bringing said two contacts into electrical engagement, said mechanical means remaining in contact engaging position indefinitely, common means operable by any of a plurality of pedals, and operative upon any of said mechanical means in contact engaging position to move said two contacts out of electrical engagement upon operation of said pedals by the feet of said musician, said divider means normally being inoperative, a source of potential for rendering said divider means operative, and a common switch operated by said common means to connect said potential to said divider means to render the latter operative.

6. An electronic musical instrument comprising means for providing electrical oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, a plurality of switches respectively operated by said digitals and respectively interconnected with said oscillation providing means and said amplifier for renderng said tones respectively audible, each of said switches comprising at least two contacts and mechanical means for bringing said two contacts into electrical engagement, said mechanical means remaining in contact engaging position indefinitely, a pivotally mounted bail pivotally operable by any of a plurality of digitals and operable upon any of said mechanical means in contact engaging position to move said two contacts out of electric engagement upon manipulation of any of said digitals, and a cantilever spring engageable with said bail intermediate its ends for supporting said bail intermediate its ends and for resiliently biasing said bail to a retracted position.

7. An electronic musical instrument comprising means for providing electrical oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, a plurality of switches respectively operated by said digitals, and respectively interconnected with said oscillation providing means and said amplifier for rendering said tones respectively audible, each of said switches comprising at least two contacts and means for bringing said contacts into electric engagement, said contacts thereafter being resiliently held in engagement, and common means operable by any of a plurality of digitals and operatively disposed to move any two electrically engaged contacts out of electrical engagement upon manipulation of any of said digitals.

8. An electronic musical instrument comprising means for providing electric oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, a plurality of switches respectively disposed adjacent said digitals, and respectively interconnected with said oscillation providing means and said amplifier for rendering said tones respectively audible, each of said switches comprising at least a fixed contact and a movable contact which are normally out of engagement, an overcenter switch mechanism carried by each of said digitals, and operatively connected to the movable switch contact of the corresponding switch, said overcenter mechanism being movable with each respective digital, fixed means engageable by a portion of said overcenter mechanism to effect overcentering therof, and concurrent movement of said movable contact into engagment with said fixed contact, said contacts remaining in engagement indefinitely due to the overcentering of said mechanism, and common means operable by any of a plurality of digitals and engageable with said overcentered mechanisms upon manual operation to return any overcentered mechanism with the associated switch contacts in engagement to initial position with said contacts out of engagement.

9. An electronic musical instrument as set forth in claim 8 wherein the overcenter mechanism associated with each digital comprises a member pivoted on its digital intermediate the ends of said member, one end of said member being operatively interconnected with the corresponding movable switch contact and the other end being engageable with the fixed means and subsequently engageable by said common means to effect overcentering in either direction.

10. An electronic musical instrument comprising means for providing electric oscillations corresponding to a plurality of different tones, an amplifier for amplifying said oscillations, electro-acoustic transducing means connected to said amplifier for converting the amplified oscillations into audible musical tones, a plurality of manually operable digitals for said instrument, a plurality of switches respectively operable by said digitals and respectively interconnected with said oscillation providing means and said amplifier for rendering said tones respectively audible, each of said switches comprising movable switch contact means operably connected to a respective digital and second movable switch contact means positioned adjacent a respective digital and engaged by the first mentioned switch contact means upon movement of the respective digital to complete a circuit, said first and second movable switch contact means subsequently remaining frictionally in engagement, and common means operable by any other plurality of digitals and operative upon said switch means

in engagement to move said switch contact means out of engagement upon manipulation of any of said digitals.

11. An electronic musical instrument as set forth in claim 10 wherein the second movable switch contact means comprises conductive means on an insulating, pivotally mounted butterfly.

12. An electronic musical instrument as set forth in claim 10 wherein one of the movable switch contact means comprises a pair of spaced apart switch contacts fixed relative to one another, and the other movable switch contact means comprises a shorting bar engageable with said spaced apart contacts.

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