

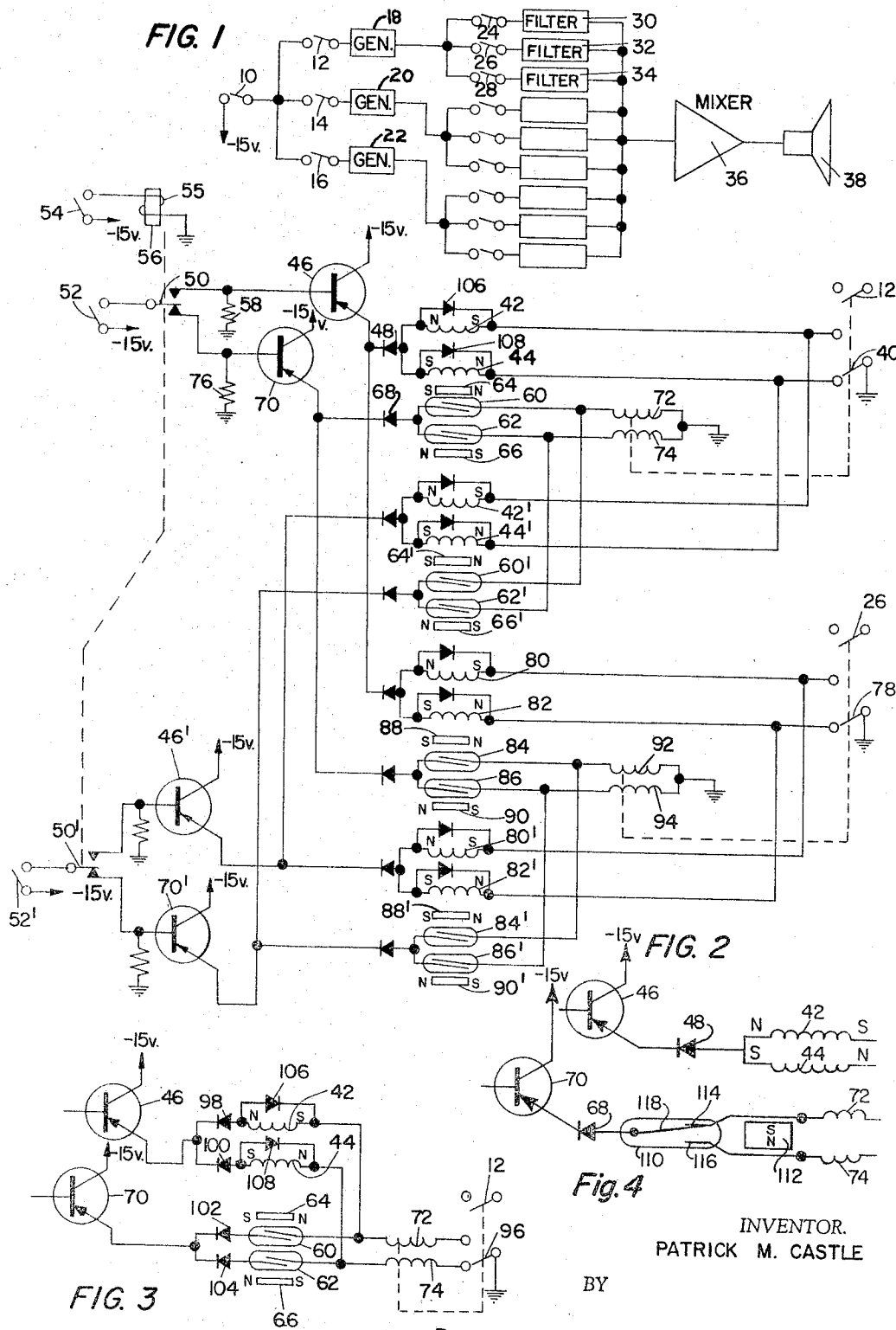
Feb. 28, 1967

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3,307,050

MEMORY SWITCHING CIRCUIT

Filed Feb. 17, 1964



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MEMORY SWITCHING CIRCUIT

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Filed Feb. 17, 1964, Ser. No. 345,159
8 Claims. (Cl. 307-112)

The subject matter of the present invention relates generally to electrical circuits for controlling the operation of mechanical switches, and in particular to switching circuits having memory devices for automatically moving the contacts of switches to preset positions after energizing such memory devices to determine such preset positions.

Briefly, one embodiment of the present switching circuit includes a memory device in the form of a pair of reed switches having magnetic contacts which are opened and closed by energizing one of a pair of operating coils associated with such reed switches, and are held in a closed position by means of a pair of permanent magnets supported adjacent the reed switches. The movable contact of the mechanical switch whose position is to be controlled, is first connected in series with one of the operating coils in one of its two switch positions and then a circuit through this coil is completed so that current flows through this coil to produce a magnetic field which closes one and opens the other of the reed switches. This sets the predetermined position of the mechanical switch because the closed reed switch is held in that position by its permanent magnet. Then, regardless of the position to which the mechanical switch is subsequently moved manually, it can later be caused to return automatically to the preset position determined by the magnetic memory circuit merely by completing a circuit which is connected to both of the reed switches to cause current to flow through the closed reed switch and one of two actuating coils connected to such reed switches. The actuating coils are associated with the mechanical switch so that the energized coil automatically moves the movable contact of such switch into its preset position.

The switching circuit of the present invention is especially useful when employed for controlling the operation of mechanical switches in the electrical circuits of musical instruments, such as electronic or pipe organs. This switching circuit may be employed as a stop combination capture circuit in such organ which functions as a memory circuit for a particular combination of stop switches on the organ. Before playing an organ the musician presets different combinations of stops on such organ and "captures" or stores these combinations by simultaneously closing a combination switch and capture switch on the organ momentarily. Subsequently, while playing the organ it is then only necessary to close the combination switch in order to reproduce the preset combination of stops.

The present memory switching circuit has several advantages over previous stop combination capture systems, including a simpler and less expensive structure. Furthermore, the present circuit has fewer moving parts and is more reliable than conventional capture systems consisting entirely of mechanical switches. Furthermore, the present switching circuit is of a small physical size, dissipates little power, is light in weight and generates little heat.

It is therefore one object of the present invention to provide a memory switching circuit for controlling the operation of a mechanical switch so that the movable contact of such switch is automatically placed in a predetermined position.

Another object of the invention is to provide an improved switching circuit for an electronic musical instrument which controls the positions of a plurality of switches

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in an efficient and reliable manner in order to provide a plurality of different predetermined combinations of musical tones.

A further object of the present invention is to provide an improved stop combination capture circuit for automatically controlling the position of stop switches in an electronic or pipe organ, which is simple and inexpensive.

An additional object of the present invention is to provide an improved stop combination capture circuit which is compact and light weight and which generates little heat and dissipates a small amount of power.

Other objects and advantages of the present invention will be apparent from the following detailed description of certain preferred embodiments thereof and from the attached drawings of which:

FIG. 1 is a schematic block diagram of an electrical circuit for producing a plurality of different musical tones by closing different combinations of stop switches in an electronic organ;

FIG. 2 is a schematic circuit diagram of one embodiment of the stop combination capture circuit of the present invention which may be employed to control the position of the stop switches shown in FIG. 1;

FIG. 3 is a schematic diagram of a portion of another embodiment of a stop combination capture circuit similar to that of FIG. 2; and

FIG. 4 is a schematic diagram of another embodiment of a magnetic switch which may be used in the circuits of FIGS. 2 and 3.

As shown in FIG. 1, an electronic organ may be provided with a separate tone generation circuit for each key 10 of the organ manuals. The movable contact of key 10 is connected to a negative D.C. supply voltage of about -15 volts and the fixed contact of such key is connected through a plurality of stop switches 12, 14 and 16 to separate individual signal generators 18, 20 and 22, respectively, which produce output signals of different frequency. The output of each of these signal generators may be connected through a plurality of different stop switches 24, 26 and 28 and filters 30, 32 and 34, respectively, of different signal transmission characteristics associated therewith to a mixer amplifier 36. The output of the mixer amplifier 36 is connected to a loud speaker 38. Thus, when the key 10 is closed along with one or more stop switches 12, 14 and 16, at least one of the signal generators is energized by the D.C. supply voltage connected to the movable contact of such key. The output signal produced by such signal generator is then transmitted through one or more of the filters 30, 32 and 34 by closing at least one of the stop switches 24, 26 and 28 associated with each signal generator. The filtered signals have different waveforms and are combined by the mixer amplifier 36 to produce a combination of signals which are transmitted to the loud speaker 38 to convert such signals into sound. Therefore, it can be seen that the output sound of the loud speaker may be varied merely by closing different ones of the stop switches to change the combination of signals transmitted to the mixer amplifier 36. The combinations of stop switches may be stored by means of the stop combination capture circuits of FIG. 2 or 3.

As shown in FIG. 2, one embodiment of the stop combination capture circuit of the present invention includes a two position stop tab switch 40 which may be ganged to the stop switch 12 of FIG. 1 so that movement of such stop tab switch also causes the stop switch to move to a corresponding open or closed position. The movable contact of the stop tab switch 40 is connected to ground while the upper and lower fixed contacts of such tab switch are connected through operating coils 42 and 44, respectively, to the emitter of a first switch-

ing or gating transistor 46 of the PNP type whose collector is connected to a source of negative D.C. supply voltage of about -15 volts. The cathode of an isolating diode 48 is connected to the emitter of gating transistor 46 and the anode of such diode is connected to the common end terminals of coils 42 and 44 so that current can flow only in one direction through such coils. The gating transistor 46 is normally biased nonconducting and the base of the transistor is connected through a magnetically operated control switch 50 and a combination switch 52 to a source of negative D.C. bias voltage of about -15 volts for rendering such transistor conducting.

The movable contact of control switch 50 is normally positioned in engagement with its lower fixed contact and is moved upward into engagement with its upper fixed contact by closing a capture switch 54. The capture switch 54 is connected between a source of negative D.C. supply voltage of about -15 volts and a solenoid coil 55 which is wound about a solenoid core 56 and grounded at one end so that energization of such coil causes the solenoid core to move upward. The solenoid core is attached to the movable contact of the control switch 50 and rotates such contact counterclockwise into engagement with the upper fixed contact of such switch. Thus, when both the capture switch 54 and the combination switch 52 are closed simultaneously the negative D.C. supply voltage connected to such combination switch, is applied across a bias resistor 58 to the base of transistor 46 and renders such transistor conducting. This causes current to flow through the gating transistor and one of the coils 42 and 44 to ground depending upon the position of the stop tab switch 40.

The operating coils 42 and 44 are wound in opposite direction about a pair of magnetic reed switches 60 and 62, having contact members of soft iron or other high permeability magnetic material. Each magnet of a pair of permanent magnets 64 and 66 is positioned adjacent a different one of the magnetic switches 60 and 62, respectively, at a position so that they exert a magnetic force on the associated magnetic switches which is insufficient by itself to close their switch contacts. The magnetic flux from the permanent magnets passes through the switches in opposite directions so that current flow through one of the coils produces a magnetic field of a polarity which is added to the field of one of the magnets and subtracted from the field of the other magnet. The field strengths are such that they cause one of the magnetic switches to open and the other magnetic switch to close. Thus, current flowing through coil 42 produces a field of one polarity which causes magnetic switch 62 to close and magnetic switch 60 to open, while current flow through coil 44 produces a field of the opposite polarity which causes switch 60 to close and switch 62 to open. The permanent magnets alone hold such contacts closed after they are moved to that position by the magnetic field of the coils 42 and 44. This means that the magnetic switches function as memory switches since they stay in an open or closed position after such coils are de-energized.

One of the contacts of each of the magnetic switches 60 and 62 is connected through an isolating diode 68 to the emitter of a PNP type switching or gating transistor 70 whose collector is connected to a source of negative D.C. supply voltage of about -15 volts. The other contact of each of the magnetic switches 60 and 62 is connected through one of a pair of actuating coils 72 and 74 to ground. The base of transistor 70 is connected to the lower fixed contact of the control switch 50 and thus is normally connected by such control switch to the fixed contact of the combination switch 50. Therefore when capture switch 54 is open, momentary closure of such combination switch applies a negative D.C. supply voltage across an input resistor 76 to the base of such transistor. This renders the gating transistor 70

conducting and causes current to flow to ground through one of the actuating coils 72 and 74 depending upon which of the magnetic switches 60 and 62 is closed. The coils 72 and 74 are each associated with the stop tab switch 40 so that when energized they move the movable contact of such switch to one of its two switch positions. The actuating coils 72 and 74 are so arranged that they cause the movable contact of the stop tab switch 40 to be placed in the original position necessary to close the magnetic switch connected to such coil. Thus, current flow through actuating coil 72 rotates the movable contact of the stop tab switch 40 into the lower position shown to ground one end of the operating coil 44. In a similar manner when actuating coil 74 is energized it causes the movable contact of the stop tab switch 40 to move to the upper position to ground one end of the operating coil 42. As a result, the magnetic memory device including actuating coils 42 and 44, magnetic switches 60 and 62 and permanent magnets 64 and 66 causes the movable contact of the stop tab switch 40 to be moved automatically into the predetermined position, originally set by first manually moving the stop tab switch in that position and then closing both the combination switch 52 and the capture switch 54, merely by subsequently closing only the combination switch. Since the movable contact of the stop tab switch 40 is ganged to the movable contact of the stop switch 12, such stop switch is also moved to its predetermined open or closed position.

Each combination switch of the present circuit may have a plurality of organ stop switches associated therewith. Thus, combination switch 52 may be connected through the control switch 50 and gating transistor 46 to a second stop tab switch 78. The fixed contacts of the stop tab switch 78 are connected through a second pair of operating coils 80 and 82 in a similar manner to coils 42 and 44. Each of these coils 80 and 82 is associated with a second pair of magnetic reed switches 84 and 86 for opening one and closing the other of such switches when one of the operating coils is energized. A second pair of permanent magnets 88 and 90 are supported adjacent reed switches 84 and 86, respectively, to hold such switches closed. Each of the reed switches is connected between the emitter of gating transistor 70 and ground through a different one of a second pair of actuating coils 92 and 94 respectively. The grounded movable contact of the stop tab switch 78 may be ganged to the movable contact of the stop switch 26 of FIG. 1. This second magnetic memory circuit functions in a similar manner to the magnetic memory circuit described above so that it will not be described in detail. Thus, if it is desired to cause the signal generator 18 of FIG. 1 to produce an output signal and to transmit such output signal through filter 32, it is necessary to close stop switches 12 and 26. This combination of stop switches can be stored by manually placing the movable contact of stop tab switch 40 in its upper position and by manually placing the movable contact of stop tab switch 78 to its upper position before closing combination switch 50 and capture switch 54 simultaneously for a short period of time. This causes coils 42 and 80 to be energized and closes the contacts of magnetic switches 62 and 86 while opening the contacts of magnetic switches 60 and 84. Permanent magnets 66 and 90 hold the contacts of magnetic switches 62 and 86, respectively, closed. Thus, when the combination switch 52 is again momentarily closed at some subsequent time, actuating coils 74 and 90 are energized by current flowing through the closed magnetic switches 62 and 86 to automatically move the movable contacts of the stop tab switches 40 and 78 to their upper positions regardless of the position into which such movable contacts have been manually placed during the interim.

It should be noted that more stop tab switches whose movable contacts are ganged to other stop switches of FIG. 1 may be provided in FIG. 2 along with associated memory circuits connected to gating transistors 46 and 70

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so that several different combinations of stop switches may be captured or stored by such circuit. In this regard a second combination switch 52' may be connected through a second control switch 50' to one of a pair of gating transistors 46' and 70'. These gating transistors are also connected through separate magnetic memory devices to stop tab switch 40 and the stop tab switch 78 and to the common actuating coils of such stop tab switches in a similar manner to the gating transistors 46 and 70 described above. The same reference numerals, except for primes, have been used on the elements of such additional magnetic memory devices which correspond to similar elements of the above mentioned memory devices. Therefore, these additional magnetic memory devices will not be described in detail for this reason. The second combination switch 52' is closed momentarily at the same time as the capture switch 54 in order to store a different combination of stop switch positions than that stored by closing the combination switch 52. Of course, in order to do this with the circuit of FIG. 2 it would be necessary to provide a third stop tab switch ganged to either stop switch 24 or stop switch 28 of FIG. 1, together with an associated magnetic memory device and actuating coils for such stop tab switch.

A second embodiment of the stop combination capture circuit of the present invention may be provided by changing the circuit of FIG. 2 as shown in FIG. 3. Since this embodiment is similar to that shown in FIG. 2, only a portion of the circuit is shown and the same reference numerals have been employed to designate similar elements. The primary difference between these two circuits is that the operating coils 42 and 44 in the circuit of FIG. 3 are connected through activating coils 72 and 74, respectively, to the fixed contacts of a stop tab switch 96 whose movable contact is grounded and ganged to stop switch 12. The other end of each of the coils 42 and 44 is connected through a separate isolating diode 98 and 100, respectively, to the emitter of gating transistor 46. When such gating transistor is rendered conducting by closing both the combination switch and the capture switch, current flows through one of the operating coils and one of the actuating coils to ground. This current is sufficient to cause one of the magnetic switches 60 and 62 to close while opening the other of such magnetic switches, but is insufficient to cause the actuating coil to change the position of the movable contact of the stop tab switch 96. One of the movable contacts of each of the magnetic switches 60 and 62 is connected through a different one of a pair of isolating diodes 102 and 104, respectively, to the emitter of gating transistor 70. When gating transistor 70 is rendered conducting by closing the combination switch, sufficient current flows through the closed magnetic switch, held in that condition by one of the permanent magnets 64 and 66, to energize the actuating coil.

Thus, if in FIG. 3 the movable contact of the stop tab switch 96 is originally placed in the upper position, operating coil 42 is energized by closing both the combination switch and the capture switch to render transistor 46 conducting. This causes magnetic switch 60 to open, and magnetic switch 62 to close and to be held in that position by permanent magnet 66. Therefore, when the combination switch alone is closed at a later time to render gating transistor 70 conducting, current will flow through the closed magnetic switch 62 and the actuating coil 74, if the movable contact of the stop tab switch 96 is then in the lower position shown. However, current flow through coil 74 causes such coil to rotate the movable contact of the stop tab switch back to its preset upper position. It should be noted that this is possible because the stop tab switch 96 is of the Klann type so that it will continue to move to the upper position even after the actuating coil 74 is de-energized by the stop tab switch breaking the connection of the coil to ground.

It should be noted that the additional isolating diodes

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98, 100, 102 and 104 are employed in the circuit of FIG. 3 to prevent the same current from flowing through the operating coils 42 and 44 and the magnetic switches 60 and 62. The current flowing through gating transistor 46 cannot flow through either of the magnetic switches 60 or 62 due to the polarity of isolating diodes 102 and 104, while current flowing through gating transistor 70 cannot flow through the coils 42 and 44 due to the polarity of isolating diodes 98 and 100. Also, a pair of shunting diodes 106 and 108 may be connected in parallel with the operating coils 42 and 44, respectively. These shunting diodes are for the purpose of preventing transient switching currents from causing undesired operation of the reed switches 60 and 62 resulting in loss of the memory switch position. Each of the operating coils in the circuit of FIG. 2 may be provided with a shunt diode for this reason. However, such diodes have been found to be unnecessary in some cases and can be eliminated.

As shown in FIG. 4, a two position reed switch 110 can be substituted for each pair of switches 60 and 62, 84 and 86 in the circuits of FIGS. 2 and 3, and the pair of permanent magnets 64 and 66, 88 and 90 may likewise be replaced by a single permanent magnet 112. The magnet 112 is positioned with its opposite poles adjacent different ones of the fixed contacts 114 and 116 of such reed switch but insulated therefrom. The movable contact 118 of the switch 110 and the fixed contacts 114 and 116 are made of magnetic material so that such movable contact is moved into engagement with one of the fixed contacts by energizing one of the operating coils 42 and 44 and is held in that position by magnet 112. The operating coils are wound in opposite directions about the switch 110 to produce magnetic fields of opposite polarity when they are energized so that coil 42 closes contacts 116 and 118 and coil 44 closes contacts 114 and 118. Thus the reed switch 110 operates in a similar manner to each pair of reed switches of FIGS. 2 and 3.

It will be obvious to those having ordinary skill in the art that various changes may be made in the details of the above described embodiments of the present invention without departing from the spirit of the invention. Thus it is to be noted that the gating transistors 46, 70, 46' and 70' are employed for the purpose of reducing the current flowing through the contacts of the control switches 50 and 50' and the combination switches 52 and 52'. Thus these transistors can be omitted if switches capable of carrying greater currents are employed. Therefore, the scope of the present invention should only be determined by the following claims.

I claim:

1. A memory switching circuit, comprising:

a source of current;

magnetic memory switch means having a pair of current paths;

a pair of operating coils supported adjacent to said memory switch means for closing one and opening the other of said current paths when one of said operating coils is energized;

a control switch means including a first portion connected between said current source and said memory switch means, and a second portion connected between said current source and said pair of operating coils, for transmitting current to either said memory switch means or to said operating coils depending upon the conductive condition of said portions of said control switch means;

an operating switch means for enabling a different one of said operating coils to be energized by said second portion of said control switch means in each of two switch positions of said operating switch means; and

a pair of actuating coils each connected to a different one of said current paths of said memory switch means for placing said operating switch means in the position set by said second portion of said control

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switch means, when said first portion of said control switch means is rendered conducting.

2. A memory switching circuit for an electronic musical instrument, comprising:

- a memory switch means including a magnetic switch means having two current paths and a magnet means for holding the contacts of said magnetic switch in one position;
- a pair of operating coils supported adjacent to said memory switch means for closing one and opening the other of the current paths of magnetic switch when one of said operating coils is energized;
- a control means including a capture switch, a combination switch and a control switch connected so that said control switch enables current to flow through said operating coils when said capture switch is closed, and said control switch enables current to flow through said magnetic switch means when said combination switch is closed;
- an operating switch means for enabling a different one of operating coils to be energized by said control switch in each of two switch positions of said operating switch means; and
- a pair of actuating coils each connected to a different one of the current paths of said magnetic switch means for automatically changing the position of said operating switch means to that set by closing said capture switch, in response to current flow through the closed path of said magnetic switch means when said combination switch is closed.

3. A memory switching circuit for an electronic musical instrument, comprising:

- a pair of first and second gating devices;
- a pair of first and second control switch means for rendering said gating devices conducting, said first gating device becoming conductive when both of said control switch means are actuated and said second gating device becoming conductive if only said first control switch means is actuated;
- a pair of first and second memory switch means connected to the second gate means, each of said memory switch means including a magnet;
- a pair of first and second operating coil means connected to the first gate means for actuating said first and second memory switch means in response to current flow through said first gate means;
- an operating switch means for energizing a different one of said operating coil means in each of two switch positions to render one of said memory switch means conducting and the other memory switch means non-conducting and to reverse the conductive conditions of said memory switch means;
- means for applying a voltage between said operating switch means and said first gate means;
- a pair of first and second actuating coil means each connected at one terminal to a different one of said memory switch means for changing the position of said operating switch means to that set by actuating both of said control switch means, in response to current flow through the second gating device and the conducting one of said pair of memory switch means when said second gating device is rendered conducting by said first control means; and
- means for applying a voltage between the other terminal of each of said actuating coil means and said second gating device.

4. A memory switching circuit for an electronic musical instrument, comprising:

- a pair of first and second gating devices;
- a pair of first and second control means for rendering said gating devices conducting, said first gating device becoming conductive when both of said control means are actuated and said second gating device becoming conductive if only said first control means is actuated;

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- a pair of first and second magnetic memory switch means connected to the second gate means;
- a pair of first and second operating coil means connected to the first gate means for actuating said first and second memory switch means in response to current flow through said first gate means;
- an operating switch means for energizing a different one of said operating coil means in each of two switch positions to render one of said memory switch means conducting and the other memory switch means non-conducting and to reverse the conductive conditions of said memory switch means; and
- means for applying a voltage between said operating switch means and said first and second gating devices; and
- a pair of first and second actuating coil means each connected between said operating switch means and a different one of said pair of said operating coil means and said pair of memory switch means for changing the position of said operating switch means to that set by actuating both of said control means, in response to current flow through the second gating device and the conducting one of said pair of memory switch means when said second gating device is rendered conducting by said first control means.

5. A capture circuit for an electronic organ, comprising:

- a pair of first and second gating devices;
- a capture switch means having a first fixed contact connected to the input of said first gating device, a second fixed contact connected to the input of said second gating device, and a movable contact normally connected to said second fixed contact;
- an input terminal;
- a stop combination switch connected between said input terminal and the movable contact of said capture switch means;
- a pair of operating coils each having one end connected to the output of said first gating device;
- a stop tab switch having a movable contact connected to ground and a pair of fixed contacts each connected to the other end of a different one of the operating coils, to energize one of said coils by closing said combination switch and actuating said capture switch means to move its movable contact to said first fixed contact and cause current to flow through said first gating device when said one coil is grounded;
- a two position magnetic switch having a movable contact connected to the output of said second gating device and a pair of fixed contacts, said magnetic switch being positioned adjacent said operating coils so that energization of one of the coils causes the movable contact and one of the fixed contacts to close and the other fixed contact to open and energization of the other coil reverses the conductive condition of such fixed contacts;
- a permanent magnet positioned adjacent said fixed contacts and applying a magnetic field of sufficient strength to hold the contacts of said magnetic switch closed but not sufficient to close such contacts; and
- a pair of actuating coils each having one end connected to a different one of said fixed contacts of said magnetic switch and having its other end grounded, said actuating coils being positioned adjacent the movable contact of said stop switch so that when one of the actuating coils is energized by closing said combination switch to cause current to flow through said second gating device and the closed contacts of said magnetic switch, said one actuating coil places such movable contact into the position required to energize the proper operating coil to close such closed contacts of said magnetic switch.

6. A capture circuit for an electronic organ, comprising:

- a pair of first and second transistors;
 - a capture switch means having a first fixed contact connected to the input of said first transistor, a second fixed contact connected to the input of said second transistor, and a movable contact normally connected to said second fixed contact;
 - a voltage source;
 - a stop combination switch connected between said voltage source and the movable contact of said capture switch means;
 - a pair of operating coils each having one end connected to the output of said first transistor;
 - a stop tab switch having a movable contact connected to ground and a pair of fixed contacts each connected to the other end of a different one of the operating coils, to energize one of said coils by closing said combination switch and actuating said capture switch means to move its movable contact to said first fixed contact and cause current to flow through said first transistor when said one coil is grounded;
 - a pair of normally open magnetic reed switches each having one contact connected to the output of said second transistor, said magnetic switches each being positioned adjacent said operating coils so that energization of one of the coils causes one of the magnetic switches to close and the other to open and energization of the other coil reverses the conductive condition of such magnetic switches;
 - a pair of permanent magnets each positioned adjacent a different one of said magnetic switches and applying a magnetic field of sufficient strength to hold the contacts of its associated magnetic switch closed but not sufficient to close such contacts; and
 - a first pair of actuating coils connected between said operating coils and the fixed contacts of the stop tab switch and each of said actuating coils having one end connected to the other contact of a different one of said magnetic switches, said actuating coils being positioned adjacent the movable contact of the first stop switch so that when one of such coils is energized by closing said combination switch to cause current to flow through said second transistor and the closed one of said magnetic switches, said one actuating coil places such movable contact into the position required to energize the proper operating coil to close such closed magnetic switch.
7. A capture circuit for an electronic organ, comprising:
- a pair of first and second transistors normally biased nonconducting;
 - a control switch having a first fixed contact connected to the input of said first transistor, a second fixed contact connected to the input of said second transistor, and a movable contact normally connected to said second fixed contact;
 - a capture switch connected to said control switch to move its movable contact into engagement with its first fixed contact when said capture switch is closed;
 - a voltage source;
 - a stop combination switch connected between said voltage source and the movable contact of said control switch;
 - a first pair of operating coils each having one end connected to the output of said first transistor;
 - a first stop tab switch having a movable contact connected to ground and a pair of fixed contacts each connected to the other end of a different one of the first pair of coils, to energize one of said first coils by closing said combination switch and said capture

- switch to cause current to flow through said first transistor when said one coil is grounded;
 - a first pair of normally open magnetic switches each having one contact connected to the output of said second transistor, said first magnetic switches each being positioned adjacent said first operating coils so that energization of one of the coils causes one of the magnetic switches to close and the other to open and energization of the other coil reverses the conductive condition of such magnetic switches;
 - a first pair of permanent magnets each positioned adjacent a different one of said first magnetic switches and applying a magnetic field of sufficient strength to hold the contacts of its associated magnetic switch closed but not sufficient to close such contacts;
 - a first pair of actuating coils each having one end connected to the other contact of a different one of said first magnetic switches and having its other end grounded, said first actuating coils being positioned adjacent the movable contact of the first stop switch so that when one of such coils is energized by closing said combination switch to cause current to flow through said second transistor and the closed one of said first magnetic switches it moves such movable contact to the position required to energize the proper inductance coil to close such closed magnetic switch;
 - a second pair of operating coils;
 - a second stop tab switch;
 - a second pair of magnetic switches;
 - a second pair of permanent magnets; and
 - a second pair of actuating coils, said second actuating coils, second operating coils, second magnets, second magnetic switches and second stop switch being connected to said transistors, said control switch and said stop combination switch in a similar manner to the corresponding first elements.
8. A stop combination capture circuit for an electronic organ, comprising:
- a plurality of pairs of gating transistors;
 - a plurality of magnetic memory devices connected to each pair of transistors, each of said memory devices including a pair of operating coils and a pair of reed switches connected to different ones of said pair of transistors, a pair of shunting diodes across said operating coils, and a pair of permanent magnets each supported adjacent a different one of said reed switches;
 - a plurality of stop tab switches each connected to a plurality of different pairs of said operating coils so that a different one of the coils of each pair of operating coils is energized in each of two positions of the stop tab switches;
 - a plurality of pairs of actuating coils supported for movement of said stop tab switches with a different pair of actuating coils associated with each stop tab switch;
 - a plurality of stop combination switches each normally connected to one transistor of a different pair of gating transistors; and
 - a common capture switch means for connecting all of said combination switches to the other transistor of the pair of transistors associated therewith.

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