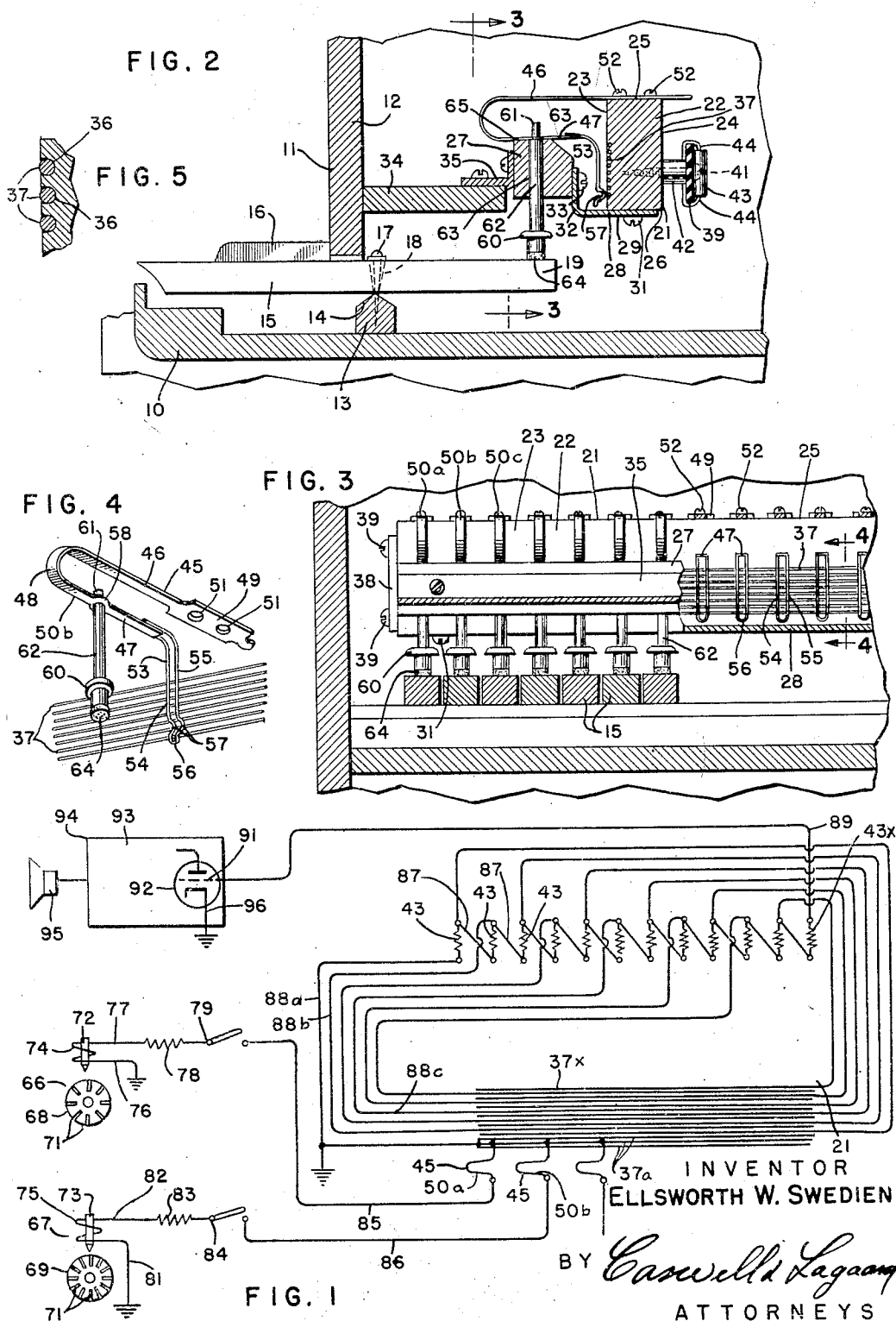


Feb. 14, 1950

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 AUTOMATIC VOLUME CONTROL FOR KEYBOARD
 OPERATED MUSICAL INSTRUMENTS
 Filed April 26, 1948

2,497,331



UNITED STATES PATENT OFFICE

2,497,331

AUTOMATIC VOLUME CONTROL FOR KEY-BOARD OPERATED MUSICAL INSTRUMENTS

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Application April 26, 1948, Serial No. 23,373

14 Claims. (Cl. 84—1.26)

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My invention relates to switch actions for electrical musical instruments and has for an object to produce an action in which the usual key thump is eliminated.

Another object of the invention resides in providing an action in which the volume of the tones of the instrument are gradually brought up to normal as the keys of the instrument are depressed.

A still further object of the invention resides in providing an action in which the rate of variation in tone volume can be manually controlled.

An object of the invention resides in providing an action in which the volume of the tones can be controlled by the extent of depression of the keys.

Another object of the invention resides in providing a musical instrument in which the noise level is reduced to a minimum.

A still further object of the invention resides in providing the action with a number of key actuated switches each having a movable contact and in further providing a number of fixed contacts having impedances or resistors connected therebetween and forming in combination an attenuator.

Another object of the invention resides in utilizing a single attenuator common to a number of switches.

A still further object of the invention resides in providing an elongated support and in arranging along the same a number of elongated contacts and in further arranging a number of the movable contacts of the switches adjacent the fixed contacts and each adapted to independently engage the fixed contacts.

Another object of the invention resides in the specific construction of the switches and the actuating mechanism therefore.

A still further object of the invention resides in providing the generators of the instrument with separate output connections and a common return and in connecting the switch blades of said switches to said output connections and one end of said attenuator to said common return, and in further energizing the sound producing device of the instrument from the output of the attenuator.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is a wiring diagram of a portion of a musical instrument illustrating an embodiment of my invention.

Fig. 2 is a cross sectional view taken through the key board and switch action of the invention.

Fig. 3 is a fragmentary longitudinal sectional

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view of a portion of the structure illustrating Fig. 2 and taken on line 3—3 of Fig. 2.

Fig. 4 is a perspective view of one of the movable switch blades of the switch action.

Fig. 5 is a sectional detail view of a portion of the attenuator taken on line 5—5 of Fig. 2.

In Figs. 2 and 3 I have shown a portion of a musical instrument which includes a key board 10 associated with a case 11 having a vertical panel 12. The key board 10 includes a fulcrum bar 13 which is constructed with an inverted V-shaped surface 14 on which the various keys 15 and 16 rest. These keys are pivoted to the fulcrum bar 13 by means of pins 17 which extend through holes 18 in said keys and which are driven into the bar 13. The keys 15 and 16 have arms 19 extending rearwardly from the fulcrum bar 13 and which operate the key action of the invention.

The key action of the invention utilizes a number of attenuators, one of which is indicated at 21 in the drawings. This attenuator consists of an elongated support 22 preferably rectangular in cross section and having a forward surface 23, a rearward surface 24, an upper surface 25 and a lower surface 26. The support 22 is attached to a pusher mounting 27 by means of a bracket 28. This bracket is in the form of an angle having one leg 29 underlying the lower surface 26 of the support 22 and secured thereto by means of screws 31. The said bracket has another leg 32 which overlies the mounting 27 and is secured thereto by means of screws 33. The mounting 27 is supported on a longitudinally extending shelf 34 by means of a bracket 35 which is similar to the bracket 28 and which is used in the same manner. Shelf 34 is supported by the case 11 and extends up to the panel 12.

The forward surface 23 of the support 22 is constructed with a number of spaced parallel grooves 36 which extend throughout the extent of the said support. In these grooves are mounted a number of bare wires 37 which are bent over the ends of the said support and are secured in position in spaced relation at the ends of the support by means of clamp bars, one of which is illustrated at 38 in Fig. 3. Two screws 39 extending through this clamp bar are screwed into the support 22 and hold the wires 37 rigidly in position. These wires form a number of elongated spaced contacts. At the rear surface 24 of the support 22 is disposed a mounting strip 39 of insulating material which is held attached to the said support and in spaced relation to the surface 24 by means of screws 41 and spacer sleeves 42 surrounding said screws. Arranged on this mounting strip are a number of resistors 43 which are held attached thereto by bending the terminals 44 of said resistors over the edge of the said mounting strip. These resistors are con-

connected together in series and the points of connection between the said resistors are connected to the wires 37 by means of conductors which will be subsequently more fully described in connection with the wiring diagram of Fig. 1.

For each key 15 and 16 is provided a switch for actuating the tone producing means controlled thereby. These switches have been indicated in Figs. 1 and 3 by the reference characters 50a, 50b, 50c, etc. The fixed contacts 37 serve as the common fixed contacts of a group of the said switch, each switch having a separate movable contact carried by a separate switch blade. These switches being all of the same construction, only the switch 50b and associated parts will be described in detail. The switch 50b is best shown in Fig. 4 and consists of a switch blade 45 constructed of resilient material. This switch blade is U-shaped in form having spaced arms 46 and 47 with a curved connecting portion 48 therebetween. The arm 46 is longer than the arm 47 having a body portion 49 at the end of the same provided with two holes 51. This body portion overlies the surface 25 of the support 22 and is secured thereto by means of two screws 52 which extend through the holes 51 and are screwed into the support 22. The innermost end of the arm 47 terminates short of the surface 23 of the support 22. This end of the arm has attached to it a finger 53 constructed of wire and bent with two parallel reaches 54 and 55 having a connecting portion 56 therebetween. The two reaches 54 and 55 are constructed with outwardly projecting bends 57 which serve as contacts adapted to bear against the outermost surfaces of the wires 37 which form the fixed contacts of the attenuator. The finger 53 may be soldered or otherwise secured to the inner end of the arm 47 and extends angularly therefrom, being substantially parallel to the surface 23.

The switches of the attenuator are operated in the following manner. In the arm 47 of the switch blade 45 is formed an enlargement 58. This enlargement has a hole in the same which is adapted to receive a pin 61 formed on the uppermost end of a pusher 62. Pusher 62 is guided for vertical movement in a bore 63 formed in the pusher mounting 27. The said pusher has a head 64 which is adapted to engage and rest upon the innermost end of the arm 19 of the particular key 15 or 16 with which the switch operated thereby is associated and is of such length that when the contact 57 is in engagement with one of the lowermost contacts 37a, the particular key with which it is associated is in normal position. The uppermost surface 65 of the pusher mounting 27 forms a stop for engagement with the arm 47 of switch blade 45 which limits the movement of said contact 57 to such position. When the keys 15 and 16 are depressed, the arms 19 are raised, pushers 62 are elevated and the switch blades 45 moved upwardly. This causes the contacts 57 to travel along the wires 37 until the said contacts reach the uppermost of the said wires. A shoulder 60 on the pusher engages the underside of the pusher mounting 27 and limits the upward movement of the contacts 57.

The musical instrument with which the switch action is associated comprises a number of generators of electrical oscillations, two of which have been diagrammatically indicated at 66 and 67. These generators include rotors 68 and 69 which have iron teeth 71 formed therein. The said rotors cooperate with core members 72 and 73 which have windings 74 and 75 mounted on

the same. One end of the winding 74 is grounded through a conductor 76 while the other end of said winding is connected by means of a conductor 77 to a resistor 78. The other end of this resistor is connected to a switch 79 forming one of the switch elements of the stop switch mechanism of the instrument. In like manner, one end of the winding 75 is grounded through a conductor 81 while the other end of said winding is connected through a conductor 82 with a resistor 83. This resistor in turn is connected to a switch 84 forming a switch element of the stop switch mechanism. In most musical instruments, it is customary to collectively control the actuation of the generators by means of one or more stop switch mechanisms. In as much as these function in the ordinary manner, only two switch elements thereof have been shown, namely switches 79 and 84, though it can be readily comprehended that as many switch elements will be required as there are generators and keys and the same will be ganged together to produce the desired results in the customary manner. Switch 79 is connected by means of a conductor 85 to the switch blade 45 of switch 50a while switch 84 is connected by means of a conductor 86 to the switch blade 45 of switch 50b. Other generators not shown are connected to the other switches. The various resistors 78, etc., are connected in series by means of a number of conductors 87. The points of connection between these resistors are connected by means of conductors 88 to the wires 37, the opposite ends of said wires being open. The first three of the wires 37 which are denoted by the reference numerals 37a are connected together and to the conductor 88a. This conductor is in turn grounded. The end resistor 83c is connected by means of a conductor 89 to the grid 91 of a thermionic tube 92 forming part of an amplifier indicated diagrammatically at 93 and forming part of a sound producing device indicated in its entirety by the reference numeral 94. This amplifier feeds a loud speaker 95. The grid return of the tube 92 is connected by means of a conductor 96 to ground. While I have shown in Fig. 1 the actual number of contacts 37 employed in an electrical instrument now in use, a lesser number of contacts have been shown in Figs. 2, 3 and 4 to simplify the illustration of the invention. It can be readily understood however, that any number of contacts 37 may be used over which the movable contacts 57 can be made to travel.

The operation of the invention is as follows:

In normal position the switch blades 45 are in the position shown in Fig. 2 with contacts 57 engaging one of the lowermost contacts 37a. This places the conductors 85, 86, etc., at ground potential. Since these switch blades are connected to one end of the windings 74, 75, etc., and the other ends of these windings are grounded through the conductors 76 and 81, the said windings are completely shorted out and no energy is transferred from the said windings to the attenuator. Thus the noise level is greatly lowered with the present invention. As one of the switches 50a, etc., is actuated, the contact 57 thereof successively engages the contacts 37. This shifts the said contact along the contacts 37 of the attenuator 21 and increases the voltage derived from the said attenuator and utilized for energizing the amplifier 93. When the contact 57 reaches the uppermost contact 37z, the entire output of the generator is impressed upon the amplifier. By pressing the keys part way

down, the volume of the tones produced by the instrument can be varied. Also the rate of change of volume can be manually varied by the rapidity by which the keys are depressed.

The advantages of the invention are manifest. With my invention key thump and blasting are completely eliminated. At the same time, the noise level is lowered to a minimum. Since the generators are shorted out when the keys are in normal position, no transfer of energy from the same to the system occurs. With my invention there is no opportunity for transfer of energy through capacity of juxtaposed components. By means of the particular construction employed, uniform pressure is exerted on the contacts throughout the movement of the same. By utilizing a finger constructed of parallel reaches of wire, two contacts are furnished for each switch blade thus insuring the positive actuation of the switches. With my invention the support for the attenuator carries all of the various parts of the same thus permitting of independent manufacture of the attenuator and subsequent assembly of the same as a unit in the instrument.

Changes in the specific form of my invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a switch action for musical instruments, an elongated support, a plurality of spaced juxtaposed grooves in a face of said support, a number of key actuated switches including a number of elongated contacts disposed in said grooves and having contact portions disposed in a common surface, a plurality of switch blades having movable contacts movable substantially in said surface and across said elongated contacts to successively make contact therewith and impedances between certain of said contacts.

2. In a switch action for musical instruments, an elongated support, a plurality of spaced juxtaposed grooves in a face of said support, a number of key actuated switches including a number of elongated contact wires in said grooves and having exposed edges arranged in common surface, a plurality of switch blades having movable contacts substantially in said surface and across said elongated contacts to successively make contact therewith and impedances between certain of said contacts.

3. In a switch action for musical instruments, an elongated support, having two oppositely facing surfaces, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed relation along one of said surfaces, a plurality of switch blades each adapted to successively make contact with said contacts and resistors disposed on the other surface of said support and connected between said contacts.

4. In a switch action for musical instruments, an elongated support rectangular in cross section and having two oppositely facing surfaces with intermediate surfaces therebetween, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed parallel relation along one of said oppositely facing surfaces, a plurality of switch blades mounted on one of said intermediate surfaces and having movable contacts adapted to successively make contact with said fixed contacts, resistors overlying the other of said opposed surfaces and connected between said fixed

contacts and a mounting for said support attached to the other of said intermediate surfaces.

5. In a switch action for musical instruments, an elongated support rectangular in cross section and having two oppositely facing surfaces with intermediate surfaces therebetween, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed parallel relation along one of said oppositely facing surfaces, a plurality of switch blades mounted on one of said intermediate surfaces and having movable contacts adapted to successively make contact with said fixed contacts and resistors overlying the other of said opposed surfaces and connected between said fixed contacts.

6. In a switch action for musical instruments, an elongated support, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed relation along said support, a plurality of switch blades each U-shaped in form and having an arm attached to said support and extending away from said support and another arm issuing from said first arm and extending toward said support, a finger on the end of said second named arm and extending angularly therefrom, a contact on said finger for successively engaging said fixed contacts, a pusher for each switch adapted to engage the second arm of each switch and impedances between said contacts.

7. In a switch action for musical instruments, an elongated support, having a planiform surface, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed relation along said surface, a plurality of flexible U-shaped switch blades each comprising an arm extending outwardly from said surface and another arm issuing from said first arm and extending toward said surface, a finger on the end of said second arm and extending substantially in the direction of extent of said surface, a contact on said finger for successively engaging said fixed contacts, a pusher for each switch adapted to engage the second named arm thereof, guide means for guiding each pusher for movement in a direction substantially parallel to said surface and impedances between said contacts.

8. In a switch action for musical instruments, an elongated support, rectangular in cross section and having two oppositely facing surfaces with intermediate surfaces therebetween, a plurality of key actuated switches including a number of fixed elongated contacts arranged in spaced juxtaposed parallel relation along one of said oppositely facing surfaces, a plurality of switch blades mounted on one of said intermediate surfaces and having movable contacts adapted to successively make contact with said fixed contacts, resistors overlying the other of said opposed surfaces and connected between said fixed contacts, an elongated mounting disposed adjacent said elongated support attaching means between said elongated support attached to the other of said intermediate surfaces and to said mounting guides in said mounting and a plurality of pushers slidably mounted in said guides and adapted to engage said second named arms to move the contacts thereof in the plane of said fixed contacts.

9. In a switch action for musical instruments including generators of electrical oscillations each having an output connection and a common return, a key corresponding with each of

said generators, a sound producing device having an input element and a return connected to said common return, said switch action comprising an attenuator having a movable contact adapted to be connected to the output connection of one of said generators and operated by the key corresponding therewith, one end of said attenuator being connected to said common return and the other end of said attenuator being connected to said input element, said movable contact being at the return end of said attenuator when its key is in normal position.

10. In a switch action for musical instruments including generators of electrical oscillations each having an output connection and a common return, a key corresponding with each of said generators, a sound producing device, said switch action comprising an attenuator having a movable contact adapted to be connected to the output connection of one of said generators and operated by the key corresponding therewith, one end of said attenuator being connected to said common return, the voltage across said attenuator serving to energize said sound producing device, said movable contact being at the return end of said attenuator when its key is in normal position.

11. In a switch action for musical instruments including a plurality of generators of electrical oscillations, each having an output connection and a common return, a key corresponding with each of said generators and a sound producing device, said switch action comprising an attenuator including a number of fixed contacts and resistors therebetween, switch blades operated by certain of said keys and adapted to independently make contact with said fixed contacts, one end of said attenuator being connected to said return, the output of said attenuator serving to energize said sound producing device.

12. In a switch action for musical instruments including a plurality of generators of electrical oscillations, each having an output connection and a common return, a key corresponding with each of said generators and a sound producing device, said switch action comprising a single attenuator for all of said sound producing devices in the form of a potentiometer having a plurality

of movable contacts corresponding in number to said keys, conducting means between one end of said potentiometer and said return, the other end of said potentiometer serving to energize said output device, conducting means between said movable contacts and said output connections and connecting means between each key and one of said movable contacts for moving said contact upon depression of the key.

13. In a switch action for musical instruments including a generator of electrical oscillation having an output connection and a return connection, a key corresponding with said generator and a sound producing device, said switch action comprising an attenuator in the form of a potentiometer having a movable contact, one end of said potentiometer being connected to said return connection and the other end being connected to said sound producing device, said output connection being connected to said movable contact, and connecting means between said key and movable contact for moving said contact upon depression of said key, said contact being in contact with the end of said potentiometer connected to said return when the key is in normal position.

14. In a switch action for musical instruments including a generator of electrical oscillation having an output connection and a return connection, a key corresponding with said generator and a sound producing device, said switch action comprising an adjustable resistor, said resistor being connected in series with said generator and sound producing device and adjusting means for adjusting the value of the resistance of said resistor in series with said generator and sound producing device and operated by said key.

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