

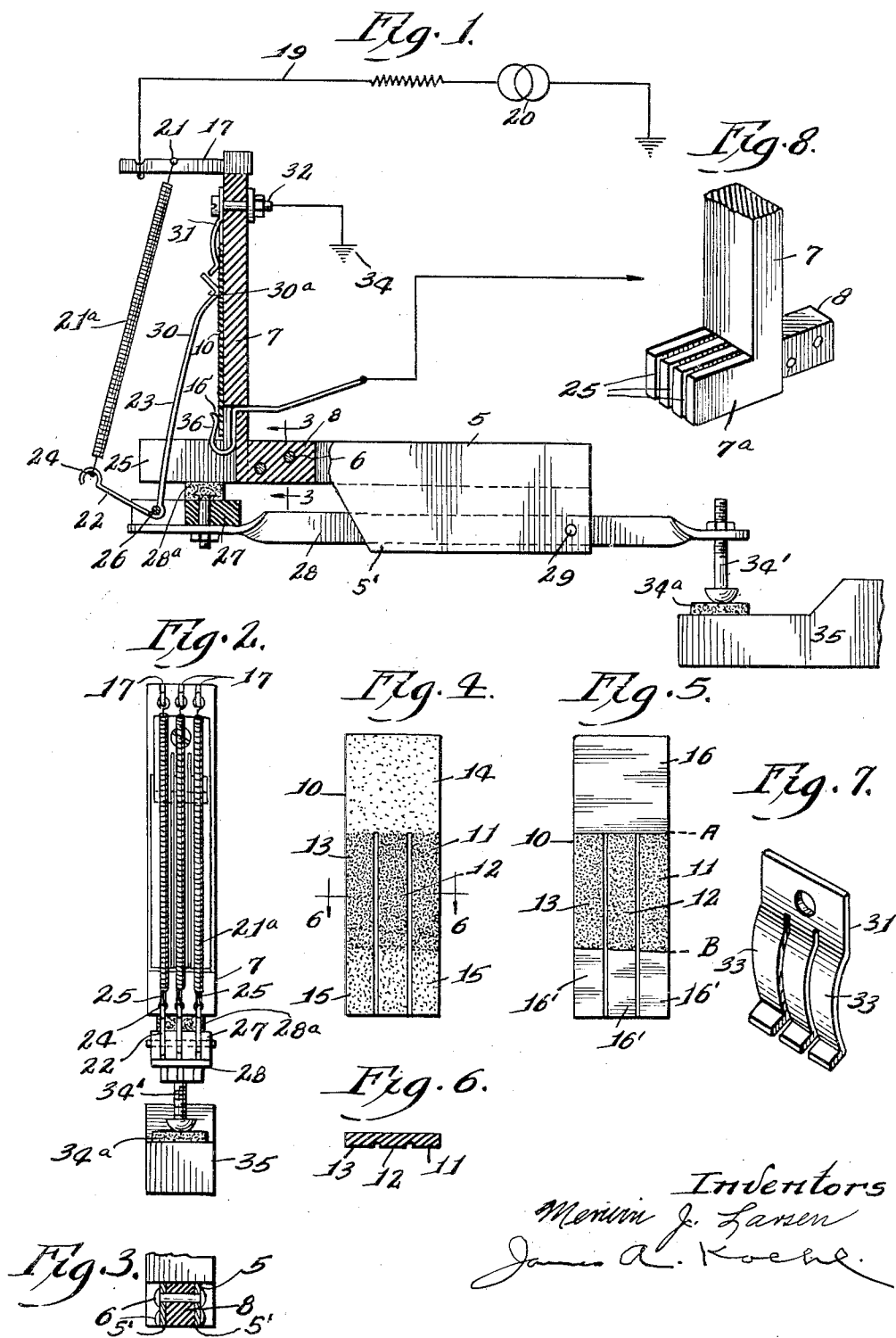
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RHEOSTAT SWITCH

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RHEOSTAT SWITCH

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This invention relates to electric switches and has particular reference to switches for use with keying circuits adapted to be interposed in an electrical network between an audio signal supply source and the power amplifier of a signal translating device.

The primary object of the invention is the provision of a variable resistive switch, the operation of which, in response to depression of a playing-key, suppresses what has come to be called "key thump" caused by the sudden surge of signal voltage when close circuiting a source of tone signal voltage with the input circuit of the power amplifier of the signal translating device.

A further object of the invention is the provision of a simple, inexpensive electric switch which is sturdy and dependable in operation and will function to vary the effective resistance in a signal transmission circuit as a function of the velocity of a control key.

A still further object of the invention is the provision of a noiseless, positively acting switch.

Other objects of the invention will manifestly appear from the following description and accompanying drawings, in which:

Figure 1 is a view partly in side elevation and partly in section of the switch and coactive control key;

Figure 2 is a view in rear elevation thereof;

Figure 3 is a section on line 3—3 of Figure 1;

Figure 4 is a view in elevation of the resistive strip before application of the metallic coating to the respective ends thereof;

Figure 5 is a view similar to Figure 4 of the strip showing the metallic coating applied thereto;

Figure 6 is a section on lines 6—6 of Figure 4, and

Figure 7 is a perspective view of the metallic clip.

Figure 8 is a view in perspective of a portion of the vertical member of the switch.

In carrying the invention into practice, use is made of a channel member 5 of any suitable well known material such as hard wood, aluminum, Bakelite, or the like. Secured at 6 between the opposite side flanges 5' of member 5 and disposed at right angles to said member, is a member 7 of electrical insulating material, the same formed at its lower end with a foot 8 confined between said side flanges 5' by the aforementioned means 6.

Placed flatwise against the front face of member 7 is a flat strip 10 of suitable well known electrical insulating material such as Bakelite.

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The front face of said strip has parallel, laterally spaced apart lanes or tracks 11, 12 and 13, each consisting of a resistive coating compound such as carbon, or other well known resistive coating, such that each lane or track is (in the present example) of the same predetermined high resistance between points A and B. The lower terminal of each of said lanes merges into a low resistive coating of carbon or other well known resistive coating indicated at 15, forming the signal voltage output end of the strip for transmission of signal voltage to the input circuit of a power amplifier from a source of signal voltage common only to the high resistive lane with which the particular low resistive coating 15 is electrically coactive. The opposite ends of said lanes merge into a carbon coating 15 which is common to all of said lanes.

Carbon, or other well known resistive coating may be painted or sprayed upon the strip 10 by any well known method and when dried either by air or heat treatment, the low resistive coating 14 at the upper ends of lanes 11, 12 and 13 and common to all thereof, will preferably have applied thereto a metallic conductive paint 16 providing a common grounding connection to be hereinafter more fully described. The low resistive coating 15 at the lower end of each separate lane 11, 12 and 13 is similarly coated with conductive paint 16'. These conductive coatings may consist of any well known metallic paint which, when applied and properly set, insure hard surfaces at the respective ends of said lanes, which said surfaces merge into said lanes so as to form therewith one perfectly smooth continuous surface which lies in a single plane.

At the upper end of the vertical portion 7 of the switch are terminal lugs 17, there being one thereof for each separate high resistive lane 11, 12 or 13. As these lugs are identical both in form and purpose, a description of one will suffice for all. In Figure 1, each separate lug 17 will connect with the output lead 19 of a tone signal supply source 20 such as a vacuum tube oscillator or any well known generator of a wave form of signal voltage of predetermined frequency. Only one lug 17 is shown connected to a signal supply source. Assuming that the switch is used with a musical instrument employing octave couplers, one of said lugs will connect with a tone frequency generator producing signal voltage, the frequency of which corresponds with an eight foot pipe tone whereas the others of said lugs respectively connect with tone signal sources providing tone signals corresponding to

4 and 16 ft. tones. Soldered at 21 to said lug is one terminal of a coil spring 21a providing a resilient conductive lead between said source 20 of signal voltage and the short arm 22 of a contactor 23, to which short arm the other terminal of said coil spring is soldered as at 24.

The rearwardly projecting portion 7a of vertical guide slots 25, there being a separate slot for each individual contactor 23. These slots are horizontally aligned with their coactive resistive lanes 11, 12 and 13 on strip 10. The contactors are each thereof mounted for pivotal motion about a center 26 on an insulating block 27 secured to the back end of a lever arm 28, pivoted for vertical motion at 29 to the forward end of member 5.

Each contactor has a long arm 30 received in a coactive guide slot 25 in portion 7a of member 7 and, as shown, the free end of said arm has an effective upset portion 30a presenting a smooth curved surface for effective electrical coaction with the resistive coating of a respective one of the aforementioned lanes.

A metallic clip 31 is secured at 32 to member 7 and is formed with parallel springy portions 33 which are firmly pressed against the conductive coating 16 of the respective lanes 11, 12 and 13 as shown at Figure 1. Said clip is connected to ground 34.

The springs 21a function to maintain a yielding, yet free sliding connection between the portion 30a of a respective contactor and its coactive resistive material on strip 10, and to urge lever arm 28 to the position shown at Figure 1. The forward end of the lever arm is provided with an adjusting screw 34' which is coactive with the back end of a vertically tiltable playing-key 35 such as the elongated key of a piano, organ or other musical instrument in which the key can pivot about a horizontal axis. When the playing-key is in the position shown at Figure 1, screw 34' rests upon a strip of felt 34a at the back end of the key and when pressure is applied to the forward end of the key, motion is transferred to the contactors 23 simultaneously moving them off of the low resistive common ground 16 and progressively onto their high resistive coatings 11, 12 and 13, the value of the resistance lowering progressively as the contactors approach their low resistive output terminals 16'. Each low resistive output coating has firmly connected thereto a terminal lead 35 adapted to be connected to the input circuit of the power amplifier of a sound translating device.

Emphasis is placed upon the structural features of the switch and the forms and shapes of the component elements to the end that smoothness in action is assured and whereby variations in the resistance is made without any break in the continuity of the movable contact element of the switch during motion of said contactor rectilinearly. By mounting the contactors 23 as shown and described herein, only a negligible degrees of pressure of the effective contact portions 30a is required for a good electrical contact between same and the resistive coating of the insulating strip 10. By proper hardening of the coating materials 16 and 16' and the resistive coatings which smoothly merge thereinto and by establishing and maintaining only a very minimum amount of pressure between same and said effective contact portions 30a, to which may be added use of German silver or its equivalent and of suitable gauge, the resistive surfaces are

kept clean and the switch is perfectly noiseless over very long periods of time. In practice, we find that by these niceties, rubbing engagement of the portions 30a of contactors 23 can be continued for a great number of operations without fear of any metal being transferred onto the resistive lanes from said portions 30a.

In order to cushion the action of the lever 28, said lever is preferably provided with a strip of felt 28a adapted to come against the under side of the foot of the member 7 when the lever 23 is returned to an "off" position of the switch. While it is preferred to coat the low resistive common ground end 14 of strip 10 with a metallic paint and similarly to apply metallic coatings 16' to the opposite ends of the lanes 11, 12 and 13, we do not wish, however, to be limited in this respect as tests have been shown that very satisfactory results are had simply by the low resistance carbon coatings when used alone. By heat treatment of strip 10 after application of the carbon thereto, the resistive surface thus formed becomes exceedingly hard and is relatively permanent. The contactors 23 give excellent results when made from German silver of suitable gauge. With the resistive surface characterized as aforementioned a positively acting switch is produced which is smooth in action, noiseless and sturdy. The high resistive zone in each of the individual rectilinear lanes may be of different resistance for different purposes but when used as a high impedance switch, said zone will preferably have a resistance of approximately 50,000 ohms, such that when the contactor leaves the grounded terminus 16 and enters and proceeds in a direction longitudinally of the intermediate high resistive zone and toward terminus 16', the change in resistance will at no time be by jumps but to the contrary will progressively lower as the contactor approaches said terminus 16'. The reversal of this operation occurs during return motion of the contactor in the direction of and back onto the common grounding terminus.

The standard width of the playing-key of an organ or a piano is approximately one-half inch. As the herein disclosed switch organization is designed and constructed primarily for use with such keyboard musical instruments, an essential feature of our invention is the embodiment in a unitary structure of a plurality of individual switches which are so formed and arranged as to enable the entire organization to be accommodated in a space not in excess of one-half inch. On reference to Figure 2 of the accompanying drawings, it is noted that the organization occupies a vertical position above playing-key 35, and that the width of the playing-key is slightly in excess of the width of said organization. It is further noted that motion of the key is simultaneously transferred to all contact elements while they are in constant yielding engagement with their coactive resistive lanes, the distance of travel of all contactors being precisely the same. This is necessary in order that the impedance in the separate output paths through said lanes shall be the same in each thereof. To the best of our knowledge no one has ever before combined in a single resistive switch organization a plurality of individual switches capable of being accommodated in so limited a space as allowed for their association with the playing-key of an organ or similar keyboard musical instrument. This is made possible by our use of a thin, stiff rectangular strip of

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insulating material, one side of which is coated with a hard resistive substance as herein set forth. This enables use of fine gauge contact wires such as 30, which wires are in parallel relation and only slightly spaced apart from each other laterally. Also by our use of a single strip of insulating material, all resistive lanes necessary for as many conductive paths can be readily insulated from each other by simply routing the material to a depth below the effective resistive coating substance after one face of the strip has been coated with the resistive substance.

What we claim as our invention is:

1. An electric switch organization for actuation by a playing key of a musical instrument comprising means having a plurality of parallel resistive lanes disposed in a common plane and each including a high resistive zone, a low resistive zone and grounding means common to said high resistive zones, a plurality of contactors coacting with the respective lanes and movable progressively from said common ground and longitudinally along said high resistive zones, and into and along said low resistive zones, voltage output terminals for the respective low resistive zones, and means including voltage input terminals and expansible and contractable metallic conductors connecting said terminals with the respective contactors.

2. In an electric switch for varying the resistance in a signal transmission path and actuable by an elongated playing-key which has pivotal motion about a horizontal axis; insulating material having a longitudinal resistive surface; means by which said material is adapted to be mounted to dispose said resistive surface at right angles to the longitudinal center line of said key; and means including a playing-key actuated contactor coactive with said resistive surface to vary the resistance in said path as a function of pivotal motion of said key.

3. In an electric switch for varying the resistance in a signal transmission path and actuable by an elongated playing-key which has pivotal motion about a horizontal axis; a thin planar strip of insulating material coated at one side with a resistive material providing a longitudinal resistive surface; means by which said strip is adapted to be mounted to dispose said resistive surface at right angles to the longitudinal center line of said key; and means electrically coactive with said resistive surface in response to motion of said key for varying the resistance in said path.

4. In a variable resistive switch for use in a signal transmission path employing a control key which is tiltable about a horizontal axis; a strip of insulating material provided with a longitudinal resistive surface; a springy contactor in constant engagement with said resistive surface and movable longitudinally thereof; and mounting means for said strip for disposing said resistive surface at right angles to the long axis of said key and including means coactive with said key for causing relative motion between said surface and said contactor with resultant pro-

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gressive changes in the effective resistance in said path during pivotal motion of said key.

5. As a new article of manufacture, a variable resistive switch organization comprising a flat rectangular strip of electrical insulating material having a plurality of laterally spaced apart, rectilinearly disposed, parallel continuous, resistive lanes at one side thereof, said lanes being electrically insulated from each other and adapted to be connected to respective signal transmission paths; means including a slidably mounted contactor for and in constant yielding engagement with each of said lanes; and an actuator common to said contactors for simultaneously sliding same along said lanes to vary the impedance in said paths.

6. As a new article of manufacture, a variable resistive switch organization comprising a flat rectangular strip of electrical insulating material having a plurality of laterally spaced apart rectilinear, continuous lanes at one side thereof, said lanes being electrically insulated from each other and adapted to be connected to respective signal transmission paths; means including a resilient contactor for and in constant yielding electrical engagement with each of said lanes; and an actuator common to all of said contactors for causing relative rectilinear motion between said strip and said contactors for simultaneously varying the impedance in said paths by even increments.

7. A switch organization as set forth in claim 5 wherein the impedance value of the resistance in each of said lanes is the same.

8. A switch organization as set forth in claim 6 wherein the impedance value of the resistance of each of said lanes is the same.

9. The combination with a playing key of a musical instrument, of a switch organization including means operated by said key and disposed perpendicular to a line drawn through the long axis thereof, said organization having a width not in excess of that of said key and including a vertically disposed, thin rectangular strip of insulating material secured flatwise against said means and adapted to be connected to a signal transmission path, and a springy contactor slidable rectilinearly on said strip and actuable by said playing-key to cause sliding motion of said contactor between the ends of said strip, said strip having a continuous resistive coating substance against the surface of which the contactor has constant yielding engagement.

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