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A. J. BISSONETTE ET AL
RENEWABLE SWITCH CONSTRUCTION

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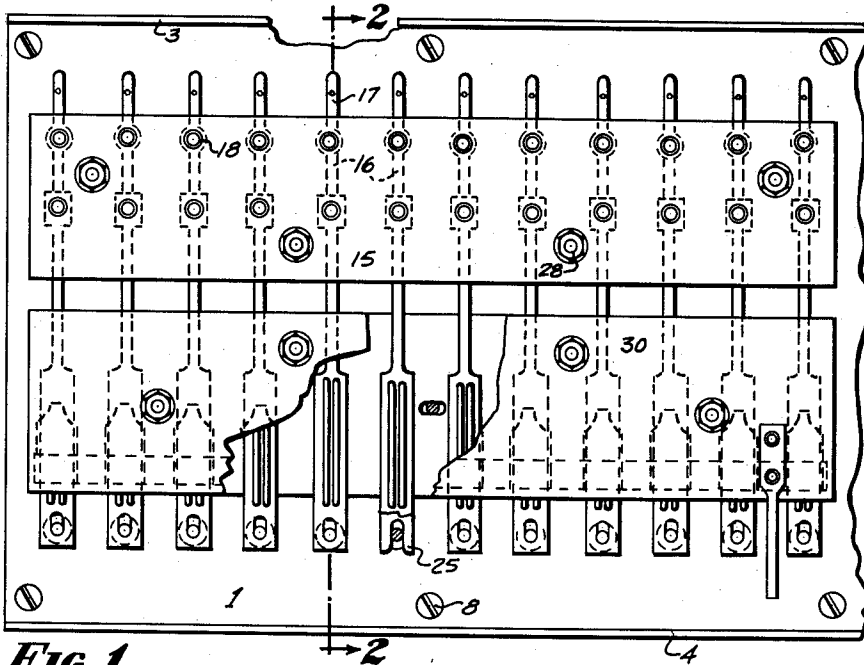


FIG. 1.

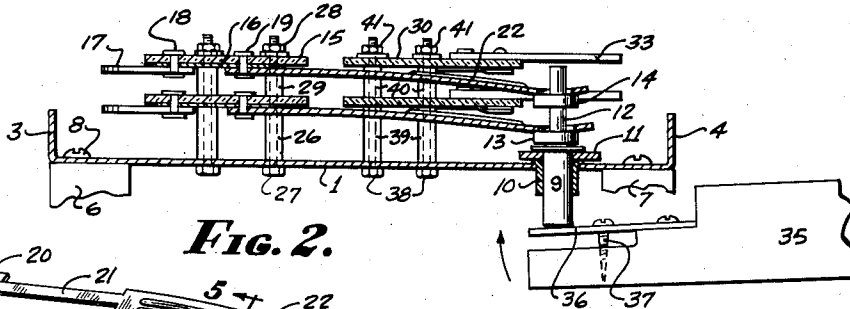


FIG. 2.

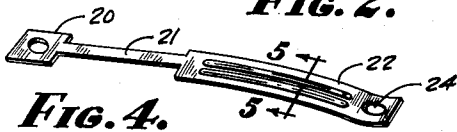


FIG. 4.

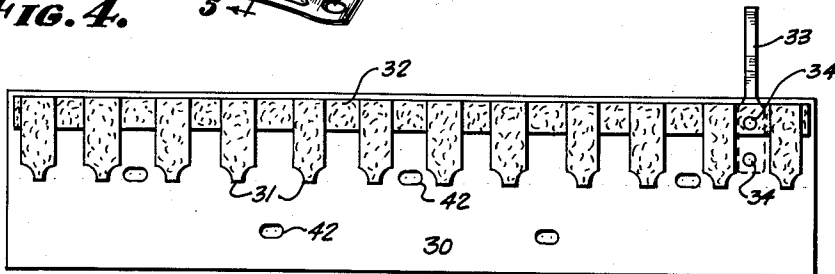


FIG. 3.

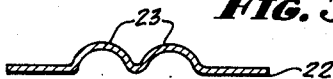


FIG. 5.

INVENTORS
ALFRED J. BISSONETTE
BY ROBERT D. LAPP,
Allen & Allen
ATTORNEYS.

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3,041,568

RENEWABLE SWITCH CONSTRUCTION

Alfred J. Bissonette, Milford, and Robert D. Lapp, Cincinnati, Ohio, assignors to The Baldwin Piano Company, Cincinnati, Ohio, a corporation of Ohio
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This invention has to do with resistive switches such as are employed to produce a gradual onset of the tones in electrical musical instruments when a playing key is depressed, or putting this another way, switches which are designed to eliminate undesirable "key clicks" or surges of current at the time an oscillator in continuous operation is connected to an output system.

A type of resistive switch which has been very widely used for the purposes set forth above is that shown in United States Patent No. 2,215,124 to Kock and Jordan, issued September 17, 1940.

In the structure of the said United States patent there are formed near one edge of an insulative base a plurality of resistive coatings extending in parallelism toward the opposite edge. On the second opposite edge there is another series of resistive coatings extending in parallelism toward the first but interconnected by a common conductor in the nature of a bus bar or header at the edge of the insulative base. The first mentioned resistive coatings are provided with individual connectors so that each may be electrically coupled to an oscillator or generator in a bank of such devices. Attached to the inner ends of the first mentioned resistive coatings there are switch blades, one for each such coating, and so configured that they normally extend over but out of contact with the second mentioned resistive coatings. If one of these switch blades is depressed, as by the engagement of a plunger with its outer end it will be brought against the inner end of the appropriate resistive coating of the second mentioned group. As the switch blade is further depressed it will rock over the second mentioned resistive coating, its point or points of contact therewith gradually approaching the said header. In some forms of the switch, the switch blades, if actuated far enough, will ultimately contact the header itself establishing direct electrical connection. The first mentioned resistive coatings act as isolating resistors for the several generators. The second mentioned resistive coatings coact with the switch blades to form first a high impedance connection between the generator and the bus or header, which connection becomes of lower and lower impedance as the switch blade is further actuated.

Resistive switches of this character are relatively inexpensive and have given a good account of themselves in practice. The resistive coatings as well as the header are usually sprayed on the insulative base through a template or mask. The switches are readily formed in gangs of varying length containing a considerable number of individual switches; and switch structures of the type described can readily be used in tandem so that the depression of one key will actuate a plurality of switches for the purpose of feeding harmonically relating oscillations into separate headers, as in the organization of that type of electrical musical instrument which is set forth in United States Patent No. 2,233,948 to Kock, issued March 4, 1947.

Switches of the type indicated handle little amperage so that sparking or burning is not a problem; and the switch blades themselves are thin and if made of suitable resilient metal, are not generally subject to failure.

Where failure occurs, it is usually due to a wearing or abrasion of the resistive coatings of the second series mentioned above. While it is an advantage of the switch

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structure that a cipher will not occur in the instrument merely because a resistive coating has become worn, it is a fact that the switches in an electrical musical instrument of this class cannot be readily changed excepting by a procedure involving a substantial amount of rewiring which is expensive and time consuming.

The principal object of this invention is the provision of a switch structure which is capable of being adjusted one or more times in such a way that fresh portions of the resistive coatings of the second mentioned series can be presented to the switch blades. Thus, in the practice of the invention, a bare adjustment of the switching means becomes equivalent to a replacement, the adjustment being readily accomplished in a very short space of time. The above and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, are accomplished by that certain construction and arrangement of parts of which an exemplary embodiment will now be described. Reference is made to the accompanying drawings wherein:

FIG. 1 is a plan view of a switch gang embodying the principles of the invention.

FIG. 2 is a cross sectional view thereof taken along the section line 2—2 of FIG. 1 and showing the relationship of the switching mechanism to a playing key.

FIG. 3 is a plan view from the underside of one section of the switching mechanism.

FIG. 4 is a perspective view of a switch blade.

FIG. 5 is a sectional view across a portion of the same switch blade taken along the section line 5—5 of FIG. 4.

Briefly, in the practice of the invention a gang switch is provided with a unitary base or support which may be a sheet of metal. The gang switch will be supported in the instrument by this sheet of metal; and it serves further to mount a series of plungers for generally vertical reciprocation, these plungers adapted to be associated each with a key and at least one switch in the gang.

The insulative base which has been mentioned above is divided into two parts longitudinally, these parts being separated but supported in substantially coplanar relationship on the base by means of supports. One of the separated portions of the gang switch structure carries the parallelly arranged and interspaced resistive coatings which serve as the isolating resistors for the generators. These coatings will each bear at one end an individual connector by which a soldered connection can be made to the appropriate generator, and at the other a switch blade as hereinafter more fully described.

The other of these separated portions carries the parallelly arranged and interspaced resistive coatings which provide for the gradual onset of the tones as hereinabove set forth. The said second portion is arranged to be movable in a longitudinal direction whereby fresh portions of the resistive coatings may be presented to the switch blades in a way hereinafter set forth.

Referring now to the appended drawings, there is shown a simple and compact form of switch construction having two decks. It will be understood by the skilled worker in the art that additional decks may be incorporated in the structure to the extent that it is desirable to cause the actuation of a large number of resistive switches by any given key. The switch comprises a metallic base plate 1 which may be stiffened by turning up its edge portions as at 3 and 4. The plate may be of any length suitable to the inclusion of the desired number of key switches, and hence is shown as broken longitudinally in FIG. 1. The plate is adapted to be supported in an electrical musical instrument either at its ends or upon rails 6 and 7 as shown in FIG. 2 to which it may be attached by screws 8.

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The base plate provides a bearing for a series of vertically reciprocable plungers 9. This may be accomplished by drawing the metal of the plate downwardly as at 10 at the positions of the holes through which the plungers extend, or by the insertion of special members in the form of grommets and the like. It is essential that the plungers slide evenly, frictionlessly and noiselessly in the bearings 10; and it is within the spirit of the invention to provide sound absorbing washers 11 and other means to this end. The upper portion of the plungers is reduced as at 12, unreduced portions forming platform-like abutments against which the switch blades hereinafter described engage. The plungers may be made as long as is required for the operation of as many decks as may be required. The plungers are of insulative plastic material, preferably such a material as a synthetic resin.

As will be appreciated from FIG. 1, each switch deck comprises a rear insulative plate 15. A series of spaced, parallel resistive coatings are sprayed on this plate. Preferably metallic connectors 17 are attached to the outer ends of the resistive coatings 16. This may be done by grommets or rivets 18 as most clearly shown in FIG. 2. To the inner ends of the resistive coatings 16 the switch blades are attached as may again be done by grommets or rivets 19. A switch blade is shown in perspective in FIG. 4 and in cross section in FIG. 5. It comprises an attachment portion 20 to be maintained in electrical contact with the inner ends of the resistive coatings 16, a relatively long, narrow and resilient neck portion 21, and a relatively wider operating portion 22. The operating portion is treated in dies to form in it one or two longitudinally extending ribs 23. These ribs have the multiple function of stiffening the portion 22 of the switch blade, of causing the portion 22 to assume permanently a longitudinally arcuate configuration, and of making direct contact with the resistive coatings on the other portion of the deck as hereinafter described. The outer end of the switch blade will either be provided with a hole 24 or a forked configuration 25 (FIG. 1) so that the switch blade end can be engaged with its own plunger 9.

The deck element 15 is supported in parallelly spaced relationship to the plate 1 by means of metallic sleeve elements 26 through which pass bolts 27 having nuts 28 on their upper ends, usually provided with lock washers or lock nuts as desired. If the switch has more than one deck the several deck elements are placed in spaced relationship by means of additional collars 29 on the bolts 27.

The other part of the switch deck comprises an insulative member 30. This member, as most clearly shown in FIG. 3, carries sprayed resistive coatings 31 extending inwardly in spaced parallel relationship from the outer edge of the member 30. The outer ends of these resistive coatings are interconnected by a bus or header 32 which is conveniently a metallic coating of low resistance, interconnecting the resistive coatings and provided with a contact means 33 (again held in place as by grommets or rivets 34), and of such character that a soldered connection may readily be made to it.

It will be understood by the skilled worker in the art that the bus or header 32 of the switch combination serves as a collector for oscillations transmitted thereto by the switch blades in the normal course of their operation. The connectors 17 will be wired to the several generators of the electrical musical instrument or to a wiring panel from which such connections may be made; and, as indicated, the resistive coatings 16 serve as anti-robbing resistors permitting a plurality of connections to any one generator. Inasmuch as the formant filter systems of many electrical musical instruments attenuate the tones unequally in the treble and bass of the instrument, the switches may be made up in gangs handling a comparatively small number of keys, say twelve keys forming an octave in the tempered scale, and the connectors 33 may

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be electrically united with a collector header through appropriate resistors to balance the scale.

In FIG. 2 there is shown a key 35 of the electrical musical instrument. This key may be considered as having a playing portion (not shown) extending to the right of the figure, and an intermediate pivot so that upon actuation of the key the lowered rear end of it will move upwardly in the direction of the arrow. The key may be provided with a leaf spring 36 and a controlling screw 37 to regulate its action upon the plunger 9.

When the key 35 is actuated by the player of the musical instrument, it will move the plunger 9 upwardly, in turn moving the outer ends of the switch blades upwardly. By reason of the arcuate configurations of the portions 22 of these switch blades they will first contact the inner ends of the resistive coatings 31 establishing a high impedance connection between a generator and the header 32. As the plunger 9 moves further in its upward travel it will rock over the resistive coating 31 because of its arcuate shape as hereinabove described, and will finally come into contact or very nearly into contact with the header 32. Thus the impedance of the aforesaid connection is lowered; the tone will have a gradual onset; and key clicks will be avoided.

The second portion 30 of any switch deck may be supported substantially in the way described for the first portion i.e. by means of bolts 38, collars 39 and 40 and nuts 41. But the deck member 30 is provided with holes 42 for the passage of the bolts 38, which holes are considerably elongated in the direction of the length of the insulative deck member 30. Thus the deck member may be supported and fixed in various longitudinal positions.

Because of the arcuate shape of the switch blade portion 22 and its rocking action as hereinabove described, there is a certain degree of wear produced on the resistive coatings 31. In the case of instruments which are played for many hours day after day this degree of wear may eventually produce a roughness in the operation of the switch elements or even prevent the formation of an adequate connection between a generator and the header 32. In the structure of this invention, when such a difficulty is encountered, it is only necessary to loosen the nuts 41 and slide the member 30 longitudinally in either direction. Since the width of the resistive coatings 31 is substantially greater than the width of the contacting portions of the ribs 23, the result will be the presentation of a fresh portion of the resistive coating to these ribs. Thus the useful operative life of switches of this character is at least doubled and in some instances may be further increased by large increments.

The increase in the operative life of the switch mechanisms will depend on various factors, and in particular the relative widths of the resistive coatings 31 and the contacting portions of the switch blades. In a structure in which the switch blades have a pair of ribs .060 in. apart, by way of example, a lateral shift of .030 in. might not fully double the life of the original structure. But a further great advantage of the structure shown and described herein is that the portion 30 of the switch structure may be renewed or replaced with no more re-wiring than is involved in the connection of the contactor 33 to the desired collector in the instrument. The switch blades, being made of beryllium-copper or other suitable spring metal last far longer than the contacted resistive surfaces. In the structure of this invention, the element 30 may be wholly replaced without disturbing any of the wiring between the generators and the switches.

As has been indicated the number of decks in each gang switch assembly may be increased as desired within the scope of the instrument. It is usual to have a plurality of individual switches operated by each key so that upon the actuation of the key oscillations of different but harmonically related frequencies may be fed simultaneously into different headers or collectors. The skilled worker in the art will understand that the headers or collectors will feed a suitable output circuit or cir-

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cuits (not shown but consisting usually of a preamplifier, an amplifier and a loud speaker) through suitable voicing circuits which are controlled by stop tabs.

Modifications may be made in the invention without departing from the spirit of it. The invention having been described in a certain exemplary embodiment what is claimed as new and sought to be secured by Letters Patent is:

1. In a resistive switch mechanism a deck comprising a first insulative panel and a second insulative panel in side by side and substantially coplanar relationship, a switch blade attached to said first insulative panel and extending across said second insulative panel, a relatively narrow means on said switch blade for making contact with a resistive coating, a coating of resistive substance upon said second insulative panel, the width of said coating being substantially greater than the width of said contacting means, and means for mounting said first and second insulative panels movable with respect to each other in a direction transverse said switch blade and through a distance at least equal to the width of said contacting means, whereby said switch blade can be caused to contact a fresh portion of said resistive coating.

2. The structure claimed in claim 1 wherein said relatively narrow means on said switch blade comprises at least one longitudinal rib for contacting said resistive coating.

3. The structure claimed in claim 1 wherein said first insulative panel carries a resistive coating in contact with said switch blade.

4. In a structure for the purpose described a base member, a plurality of plungers mounted for longitudinal movement through said base member, and a switch deck comprising a first insulative panel and a second insulative panel, said first insulative panel having attached thereto elongated switch blades a portion of which extends across said second insulative panel, resistive coatings on said second insulative panel for each of said switch blades and arranged to be contacted thereby when said switch blades are actuated, means for mounting said first and second insulative panels in spaced relationship to said base and in parallelism to each other, connections between said switch blades and said plungers respectively

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and means for effecting a relative shift in the longitudinal positions of said first and second insulative panels whereby to alter the area of contact of said switch blades with said resistive coatings and connections between said switch blades and said plungers whereby to cause said switch blades selectively to contact said resistive coatings.

5. The structure claimed in claim 4 wherein said first mentioned insulative panel carries resistive coatings in contact with said switch blades and means for making contact with said several resistive coatings.

6. The structure claimed in claim 5 wherein each switch blade comprises a mounting portion fastened to the first mentioned insulative panel, a relatively narrow resilient neck portion, and a relatively wider operating end, which operating end is configured to present at least one relatively narrow rib to the resistive coatings on said second insulative panel and wherein the operating ends of said switch blades have a longitudinally arcuate configuration so that they will rock over the resistive coatings on said second insulative panel.

7. The structure claimed in claim 6 wherein the resistive coatings on said second insulative panel have their outer ends interconnected by a conductive coating on said insulative panel.

8. In a resistive switch mechanism, a deck comprising a first insulative panel and a second insulative panel, a switch blade attached to said first insulative panel and extending across said second insulative panel, a coating of resistive substance upon said second insulative panel, a means on said switch blade substantially narrower than said coating for making contact therewith, and independent means for mounting said first and second insulative panels upon a support in substantially coplanar relationship, said second insulative panel being movable transversely of said switch blade a distance at least equal to said contacting means without disturbing said first insulative panel and said switch blade.

References Cited in the file of this patent

UNITED STATES PATENTS

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2,513,415	Larsen et al. -----	July 4, 1950