

March 15, 1966

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3,240,857

SWITCHING SYSTEM FOR ELECTRICAL ORGANS

Filed Oct. 29, 1962

4 Sheets-Sheet 1

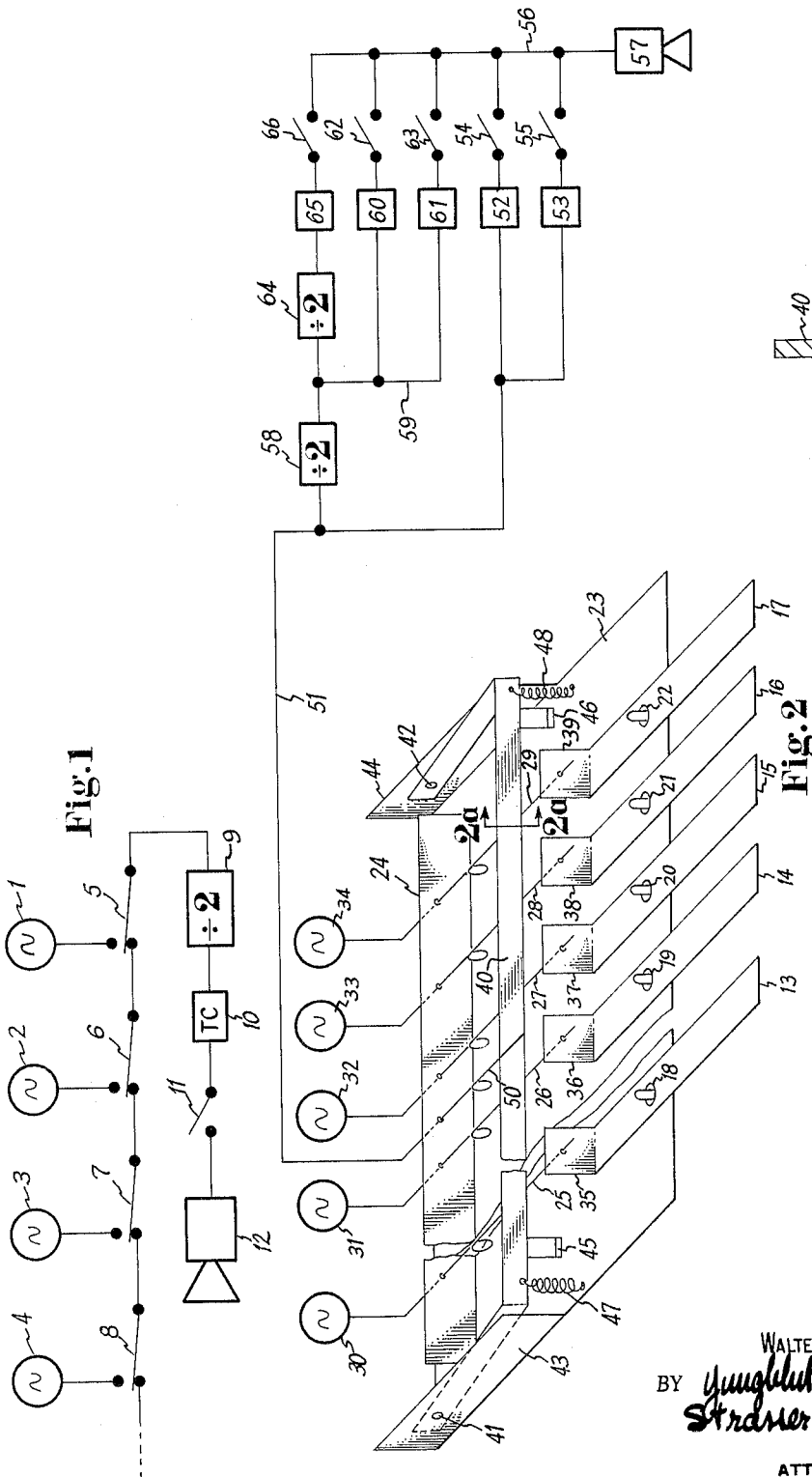


Fig. 2a

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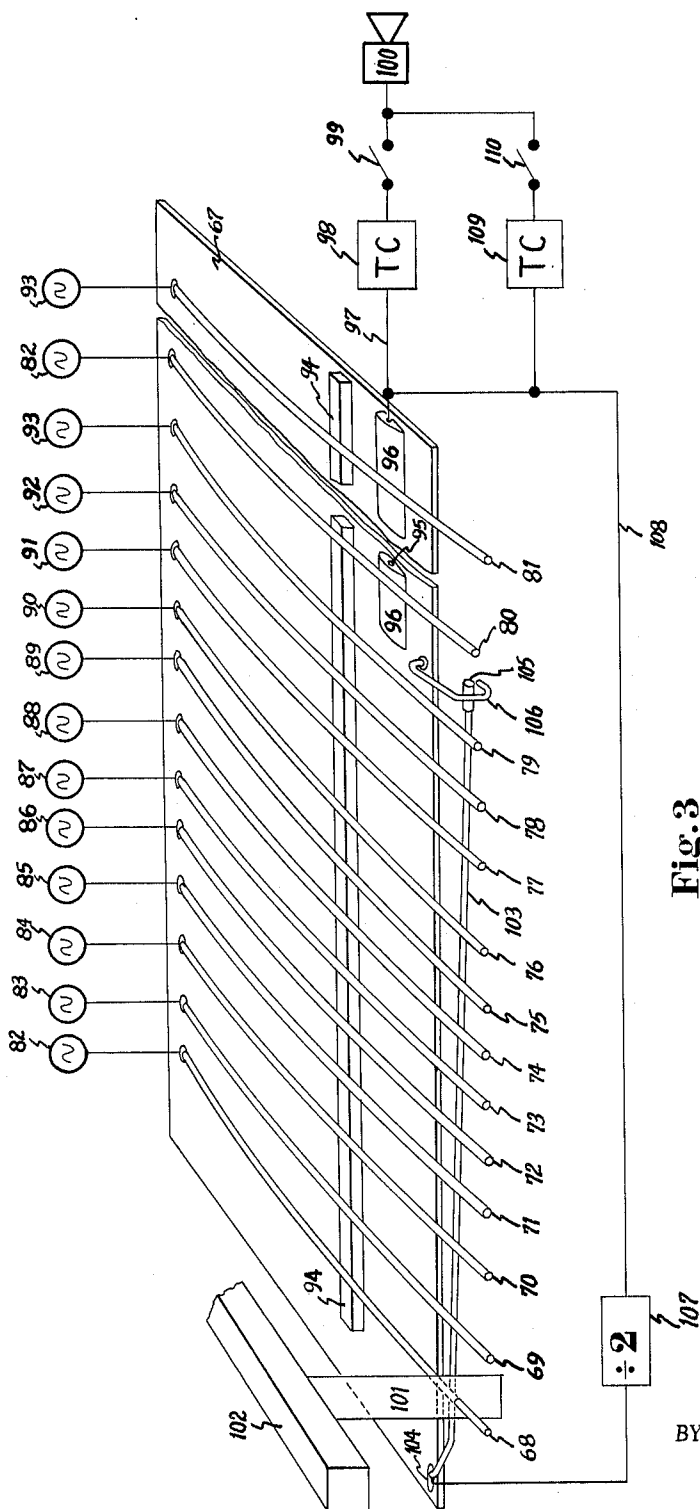
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4 Sheets-Sheet 2



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SWITCHING SYSTEM FOR ELECTRICAL ORGANS

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4 Sheets-Sheet 3

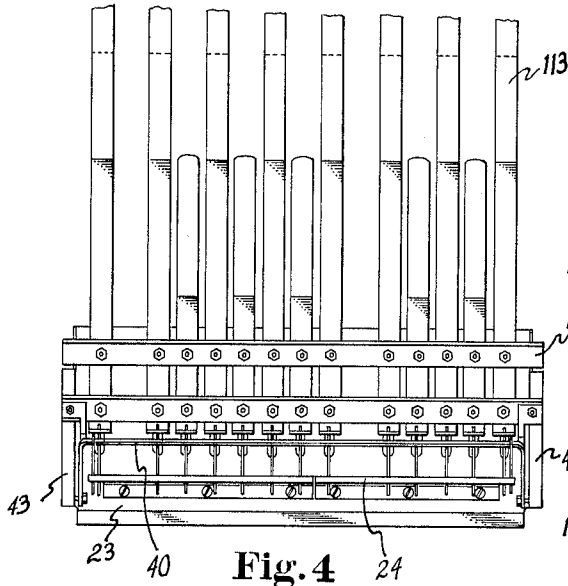


Fig. 4

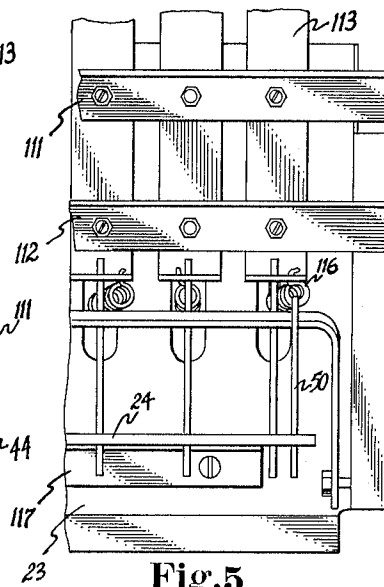


Fig. 5

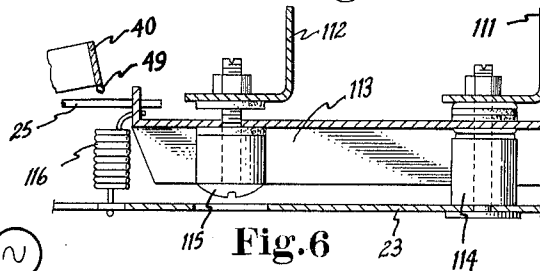


Fig. 6

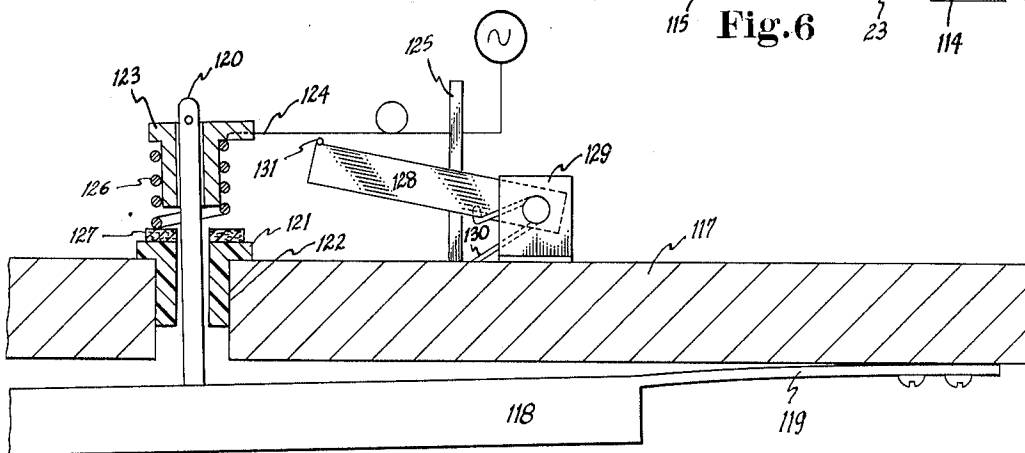


Fig. 7

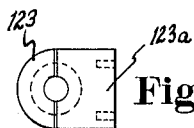


Fig. 7a

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SWITCHING SYSTEM FOR ELECTRICAL ORGANS

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7 Claims. (Cl. 84-1.01)

The invention relates to improvements in tone signal switching systems for electrical organs. In particular, it has to do with types of instruments in which generators are provided for tone signals in a certain register consisting of one or more octaves, but in which tone signals in a still lower octave or octaves are derived from some at least of the same oscillation generators in a circuit having one or more frequency dividers incorporated therein. In such instruments a saving in cost is attained with the sacrifice of polyphonism in the octave or octaves below the first mentioned range.

The invention is useful not only in providing low tone signals upon actuation of the keys in a pedal clavier, but also may be used to provide tone signals for the lowermost octave or octaves when actuated by the keys of a manual keyboard.

For example, it has been a practice in some electrical musical instruments to provide a frequency divider, such as a "flip-flop" electronic circuit to halve the frequency of tone signals, so as to attain a 16' pedal note which is not available as such from the generator system of the organ. Many electrical organs make use of twelve series of electronic oscillators, where the controlled oscillators in each series bear an octave relationship to each other, the series being related to each other as the twelve semitones of the tempered musical scale, as in the United States Patent No. 2,233,948 to Koch. Where in a lower octave or octaves polyphonism is not necessary, it has been found that the combination of one or more flip-flops and a simple switching system is more economical than providing one or more additional electronic divider stages in each of the series. The invention will be described in connection with such an instrument, although the specific nature of the sources of oscillations does not constitute a limitation upon the invention.

It has also been a practice to provide a group of, say, thirteen pedal operated, single pole, double throw switches in connection with the flip-flop divider. In the "off" position these switches are in series, the series being connected at one end to the flip-flop. When a pedal key is actuated, the series chain is broken, and the switch of the pedal key connects the flip-flop to a signal source in the generator system of the instrument thereby directing its tone signal to the flip-flop for division to produce a lower pitch. Economies are attained in this way; but experience has shown that poor contact in any one switch of the series chain can cause some or all of the pedal notes to fail to reach the output system. Also, two fixed and one movable contact are required for each note, with the attendant necessity for individual adjustment.

It is a further object to provide an improved switching construction of the class described, which is easier to assemble and adjust.

It is a still further object of the invention to provide a switching system of the class described, which is adaptable either for pedal keying or for manual keying purposes.

These and further objects, which will be obvious to one skilled in the art upon reading these specifications, are accomplished by those embodiments to be described and which are illustrated in the accompanying drawings.

FIG. 1 is a schematic diagram of a prior art system.

2

FIG. 2 illustrates an embodiment which is applicable to a pedal keying system.

FIG. 2a is a cross sectional view on an enlarged scale along the section line 2a-2a of FIG. 2.

FIG. 3 shows an embodiment incorporated into a manual keying system.

FIG. 4 is a plan view of a pedal structure employing the switching system of the present invention.

FIG. 5 is a partial plan view of the elements of FIG. 4 on an enlarged scale.

FIG. 6 is a cross sectional view of a portion of FIG. 5.

FIG. 7 is a partial side elevation of a pedal structure employing another embodiment of the switching system of the present invention.

FIG. 7a is a plan view of the pedal down stop and wire switch element engaging means of the structure of FIG. 7.

FIG. 8 is a partial plan view of a commercial embodiment of the switch of FIG. 3.

Reference is now made to FIG. 1 wherein the essential elements of a prior art structure are represented as a series of continuously operating tone signal sources 1, 2, 3, 4, etc., which are connectable by single-pole, double throw switches 5, 6, 7, 8, etc., to a series combination of a flip-flop 9, a tone color filter 10, a stop switch and a sound output system 12. One skilled in the art will be aware that a source 1, for example, may generate a complex wave of say 128 c.p.s., which, upon actuation (by a pedal key not shown) of the movable contact of switch 5 to its upper position, will be transmitted to the flip-flop 9. The output of this dividing circuit may be, for example, 64 c.p.s., which, in turn, may be modified as desired by a suitable tone color filter 10. Upon actuation of a stop tab (not shown) the stop switch 11 makes the desired tone available to the output system 12, which may be thought of as comprising a suitable electronic amplification system and one or more loud speakers.

In the practice of the invention, a gang switch is provided including a plurality of movable switch elements. These switch elements may be in the form of resilient wire or wire-like members. Each such element is connected at one end to a generator in the rank of generators to which reference has been made above. The movable switch members extend in general parallelism, and are connected at their other ends to playing key means so as to be moved upwardly or downwardly by them. Across all of the movable switch members in the group, there extends a transverse movable member which is connected through one or more flip-flop dividers and tone color means to an output system. The actuation of any given key in the group first brings the movable contact member appropriate to that key against the transverse movable member, thus coupling the appropriate generator to the flip-flop divider. At the same time, it moves the transverse movable member further away from the wire-like elements of the other keys in the group. In one aspect of the invention, this makes it unlikely that the wire-like element of any other playing key will contact the transverse movable element. In another aspect of the invention means are provided which render such accidental contact impossible. Each switch, however, operates independently, and the transmission of oscillations from a generator to the flip-flop divider is not dependent upon the operation of any other switch.

To present one embodiment of this invention, FIG. 2 illustrates diagrammatically a switching system for a group of say thirteen pedal keys in an abbreviated pedal clavier for a small electronic home organ. Five pedal keys are indicated at 13, 14, 15, 16 and 17. These will be understood as pivoted at 18, 19, 20, 21 and 22 to a base member 23 of some suitable character. No attempt

has been made to illustrate the "black" keys of the clavier.

The base is shown as supporting an insulative panel 24 on edge. Certain movable wire-like switch contact members 25, 26, 27, 28 and 29 are shown as supported at one end on the panel 24 and also as connected at that same end to generators 30, 31, 32, 33 and 34 respectively. The wire-like contact members (which may be of highly conductive spring wire plated with silver or other metal suitable for electrical contact purposes) may be mounted on the panel 24 by passing their ends through and soldering them to grommets fastened in the panel. The elements 25 to 29 inclusive may be looped intermediate their ends as shown to increase the range of their resilient action. The outer ends of the wire elements 25 to 29 will be engaged as shown in upstanding elements 35, 36, 37, 38 and 39 on the inner ends of the pedal keys. These parts may be insulative in character, or if not, they will be provided with insulative grommets as well understood in the art. It will also be seen from the diagrammatic figure that when the keys are in the rest position, the wire elements 25 to 29 inclusive lie within a single plane.

A U-bar 40 is shown with its base lying above the plane of the wire elements 25 to 29. The legs of the U-bar are pivoted at 41 and 42 to upstanding insulative brackets 43 and 44 mounted on the base 23. The downward position of the base of the U-bar is defined and maintained by insulative abutments 45 and 46; and the U-bar is biased to the downward position by springs 47 and 48 or any other suitable means.

As shown in section in FIG. 2a, the U-bar 40 will have a sufficient depth for rigidity and preferably is provided with a plated contact wire 49 along the lower edge at least of its base. Electrical contact may be maintained with the U-bar by one or more wire elements 50 which are engaged with the U-bar or with its wire edging 49, but are not engaged with any key.

The contact wire 50 is connected with a lead 51. This lead is shown as connected directly with tone color filters 52 and 53 having stop switch means 54 and 55 leading to an output bus 56. The output bus is shown as connected to an output system 57. By the means just described 8' tones in various tone colors may be derived in the output system.

The lead 51 from the U-bar is also shown as connected through a flip-flop divider 58 to a bus 59. Between this bus and the output bus 56 are shown a plurality of filters 60 and 61 each with its stop switch 62 or 63. By reason of the divider 58 in the circuit, if the oscillations passing through the tone color filters 52 and 53 may be classed as 8' tones, the oscillations passing through the filters 60 or 61 may be classed as 16' tones. In the usual organ the filters 52 and 53 will be of such character as to give flute and horn timbres, while the filters 60 and 61 will be of such character as to give diapason and bourdon voices. If deeper tones are desired, the header 59 may be connected through a second flip-flop divider 64 and a tone color filter 65 and stop switch 66 to the output header 56. In this way 32' tones may be derived in the output system.

FIG. 2 is diagrammatic in nature but will serve to illustrate the operation of the mechanism. The base of the U-bar 40 is normally maintained out of contact with any of the movable wire-like switch elements. Upon the depression of any one of the pedal keys, such as the key 13, its wire contact element 25 will be moved upwardly into contact with the wire 49 on the edge of the U-bar. A tone signal will then be transmitted to the output system in a way which will be clear from the description above. But the upward movement of the wire contact element 25 will result in the upward movement of the base of the U-bar (which swings about its pivots 41 and 42) so that the base of the U-bar will be moved further away from the wire contact elements 26 to 29, making any accidental contact of these elements with the U-bar very unlikely.

In electrical organs having an abbreviated pedal clavier, it is the practice to play upon such a clavier monophonically, i.e., the organist intentionally strikes only one pedal key at a time. The use of the U-bar construction hereinabove described eliminates the chance that a slight inadvertent depression of a pedal key, when one pedal key has been fully depressed, will connect a second generator to the output system. It is true that an equal and concurrent full depression of two separate pedal keys could result in the simultaneous derivation of two signals from two different sources in the lead 51; but the chances of this occurring inadvertently are extremely small, so that the arrangement is entirely satisfactory for an instrument with an abbreviated pedal clavier.

Turning now to FIG. 3, there is diagrammatically shown a switching arrangement which, while primarily designed for use with manual keyboards in electrical musical instruments is nevertheless adaptable for use with the more extended types of pedal claviers. A switching arrangement extending over more than one octave is shown. On an insulative base 67 there are fastened a series of wire-like movable switch contact devices 68 to 79 inclusive for tones which will be an octave below the lowest octave of generators in a generator rank of the instrument. The right hand end of the switch assembly is shown as broken; but it may be understood that movable contact elements 80 and 81 are representative respectively of the lowest generator in the generator rank and of a generator twelve semitones thereabove. The contact elements 68 to 79 are diagrammatically indicated as connected respectively with generators 82 to 93 inclusive. Contact element 80 will also be connected to generator 82 while contact element 81 will be connected to generator 93. These connections will be effected through suitable isolative resistors (not shown) as is current practice in the art.

Normally, in instruments employing a rank of continuously operating generators, resistive or gradual contact switch means are employed for the derivation of oscillations in accordance with the requirements of a musical composition. The use of such gradual contact switches avoids key thump and key click. Any type of resistive switch may be employed such as the structures shown in United States Patent No. 2,215,124 in the names of Koch and Jordan, dated September 17, 1940. In FIG. 3 the right hand portion of the switching assembly is of a type set forth and claimed in a copending application in the name of Marion B. Gregory entitled, Variable Resistance Key Switch, filed October 29, 1962, Serial No. 233,529. Thus the base or panel 67 is shown as carrying an insulative fulcrum bar 94 to control the action of the wire-like movable contacts, and the stationary contact means is a bus or wire 95 covered with a resistive coating or body 96 which is preferably deformable. The bus 95 is indicated as connected to a lead 97, connected to voicing means, one of which is shown as a filter 98 and stop switches one of which is shown at 99 and to an output system 100. By these means, and the use of other similar switches connected to other generators in the generator rank, tones of different timbre can be developed in the output system. Furthermore, the skilled worker in the art will understand that the instrument may comprise a plurality of banks of switches simultaneously operable by the playing keys, especially where the derivation of octavely related oscillations in different headers is desired for voicing purposes. In FIG. 3 a purely diagrammatic illustration of a connection 101 between the movable contact member 68 and a playing key 102 is shown, it being understood that the several movable switch elements will be connected respectively with playing keys in a manual or clavier.

The movable contact elements 68 to 79 are arranged to provide an extra number of notes of frequencies an octave below the frequencies of the lowest generators in the generator rank of the instrument. Upon the

depression of any of the contact elements 68 to 79 by its appropriate playing key contact will be made with a wire element 103 which is shown as extending transversely beneath the movable contact elements. This does not provide for resistive or gradual contact switching in the lowermost octave; but initial transients are of less importance in low frequency registers.

The wire element 103, which is fastened to the panel 67 at one end, as at 104 not only extends beneath the movable contact elements 68 to 79 but lies somewhat aslant to the plane of these contact elements. The free end of the wire, which may be provided with an insulative and anti-friction bushing 105 will usually lie within a bracket element 106 fastened to the panel 67 and serving to guide the motion of the wire. Upon the depression of any one of the movable contact elements by means of its appropriate key, it will be brought into contact with the wire 103. This wire is connected, through a flip-flop divider 107 to a lead 108 which connects with the lead 97. An additional tone color circuit 109 and its stop switch 110 is also shown. The more elaborate circuitry which has been diagrammatically illustrated in FIG. 2 can be used in connection with the switch means of FIG. 3, and by the same token, the skilled worker in the art will understand that more than one octave of notes lower than the lowest full octave of generators in the generator rank may be provided monophonically through the use of two or more flip-flop dividers in series.

The operation of movable contacts 68 to 79 will be similar to that described in connection with FIG. 2. The wire member 103 acts in a way similar to the base of the pivoted U-bar, in that if a movable contact member is brought against it through the actuation of a playing key, the wire 103 will be moved away from the plane of the unactuated contact members. But because the wire 103 lies aslant to the plane of the unactuated contact members, its depression by an actuated contact member will result in the movement of that part of the wire extending beyond the movable contact member in one direction so far away from the other movable contact members lying beyond the actuated member in the same direction, that these movable contact members cannot possibly be brought against it even though their respective keys be fully depressed. Thus, monophonicism will be enforced; and only the highest note or lowest note in the octave can sound, depending upon which end of the wire 103 is pivoted to the insulative panel 67.

FIGS. 4, 5 and 6 illustrate a commercial embodiment of a pedal clavier arrangement, in which like parts have been given like index numerals and will not be redescribed. The arrangement includes a frame comprising the base member 23, the end members 43 and 44 and a pair of spaced longitudinal angle irons 111 and 112. The pedal keys, one of which is indicated at 113 in FIG. 6 are in effect pivoted to the angle iron member 111 and the base 23 by a bolt, collar and resilient washer structure shown at 114 in FIG. 6. An adjustable bolt arrangement 115 in the same figure is used to level the pedal keys in their unactuated positions and to limit the extent of their movement when actuated. This arrangement engages angle iron means 112. The keys may be urged toward their unactuated positions by coil springs 116 engaged between the rear ends of the keys and the base 23. The insulative panel 24 is so marked and it is shown as held to the base 23 by bracket means 117. The arrangement of the movable switch contact means and the U-bar will be the same as that hitherto described. The contact element 50 which engages the U-bar at all times may, if sufficiently strong and resilient, take the place of spring means 47 and 48 diagrammatically illustrated in FIG. 2.

A somewhat different arrangement for the pedal clavier is shown in FIGS. 7 and 7a. Here a base 117 is

provided, and the pedal keys, one of which is shown at 118, are pivotally mounted to the underside of the base by leaf spring means 119. The pedal keys carry plungers 120 which extend upwardly through bushings 121 in holes 122 in the base. The plungers carry heads 123 which serve a dual purpose. They limit the extent of the downward movement of the pedal keys upon actuation. Also, they are provided with extensions 123a which engage and operate the contact wires 124. These are supported on the vertical insulative panel 125 similar to the panel previously described.

A return spring 126 for the pedal keys may be engaged between the head 123 and the bushing 121 as shown, with the interposition of a felt washer 127 for sound deadening purposes.

In this instance the U-bar 128 will be pivoted to brackets 129 on the base, and will lie beneath the movable wire contact elements as shown. It may be urged toward the contact elements by hinge spring means 130. Needless to say, stops (not shown) will be provided to define the upper position of the U-bar. The contact wire hitherto described in connection with the U-bar will now lie along its upper edge as at 131. The operation of the structure of FIGS. 7 and 7a will be clear from the description above.

FIG. 8 shows a commercial embodiment or part thereof corresponding to the switching means diagrammatically illustrated in FIG. 3. Like parts have been given like index numerals. It will be understood that the insulative panel 67 may be extended in either direction. The panel is shown as provided at its rear edge with soldering lugs collectively indicated at 132. Grommets 133 are fastened to the insulative panel, and downturned ends of the movable contact members are soldered to these grommets. The isolating resistors which have heretofore been mentioned may be soldered between the grommets and the lugs 132 as indicated at 134.

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

1. In a switching system for an electronic organ having a plurality of sources of musical tone signals and an output system, the combination comprising:

- (a) a plurality of movable switch contacts respectively coupled to said sources,
- (b) a movable common contact member coupled to said output system and biased toward said switch contacts but normally out of contact therewith, and
- (c) a plurality of keying means respectively associated with said switch contacts for urging them selectively against said common contact member and for moving the latter away from unselected switch contacts.

2. The combination claimed in claim 1 wherein said common contact member may be displaced substantially equally from all said contacts, whereby two of said contacts will not touch said common contact member unless the keying means associated therewith are depressed a substantially equal distance.

3. The combination claimed in claim 1 wherein said common contact member is movable about a point substantially in line with said contacts, whereby when said common contact is moved by a movable switch contact, it will be carried to a position so far away from certain other movable switch contacts in the group that said other movable switch contacts cannot establish connection with said common contact even when fully actuated.

4. The combination claimed in claim 3, said output system including:

- (a) a frequency divider connected to said common contact member and

7

(b) a tone color and amplification system connected to said frequency divider.

5. The combination claimed in claim 4 including:

(a) at least one additional key switch connected directly to said tone color and amplification system.

6. In a structure of the class described, an insulative panel means, a plurality of wire-like movable contact elements extending in substantial parallelism and mounted at one end on said panel, a plurality of playing keys, operative connections between said playing keys and respective ones of said movable contact elements, a common contact member having a portion at least extending transversely of said movable contact elements and normally lying in a position to be contacted by said movable contact elements upon actuation thereof by their respective playing keys, said common contact

8

member being mounted so as to be movable by said movable contact elements to a position further away from other movable contact elements in the group.

7. The structure claimed in claim 6 wherein the said common contact member is in the form of a pivoted U-bar biased towards said movable contact elements but held out of contact with unactuated ones of said movable contact elements by abutment means.

References Cited by the Examiner

UNITED STATES PATENTS

2,846,916	8/1958	Osborne et al.	
2,931,877	5/1960	Henley.	
2,969,439	1/1961	Dubois	200—18

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