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KEY SWITCHING AND OCTAVE COUPLING MECHANISM

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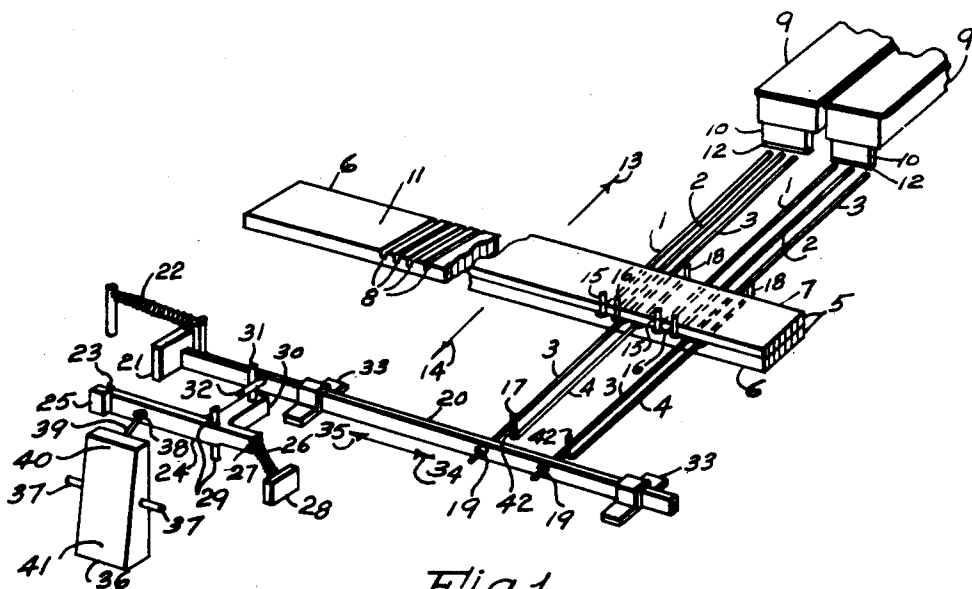


Fig. 1.

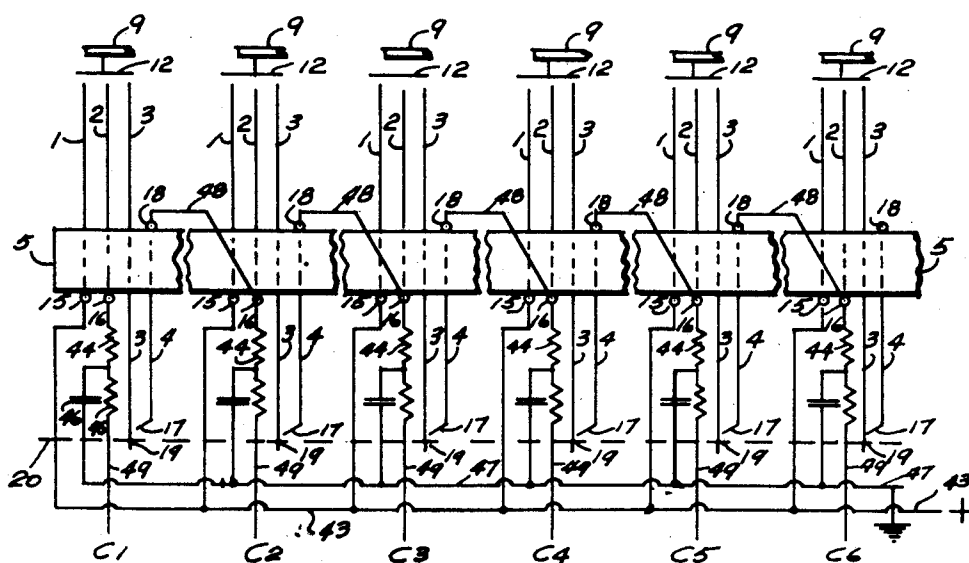


Fig. 2.

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KEY SWITCHING AND OCTAVE COUPLING MECHANISM

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My invention relates to key actuated switches and more particularly to a key switching and octave coupling device as applied to an electronic organ.

The principal object of the invention is to provide a novel key switching and octave coupling mechanism that can be economically manufactured.

Another object of the invention is to provide a switching mechanism requiring the minimum number of soldering connections.

Another object of the invention is to provide a switching mechanism with a novel means of actuating the novel octave coupling feature.

Another object of the invention is to provide a switching mechanism with a novel means of supporting the contacts.

Other objects and advantages of the invention will become apparent from the following description when read in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective illustration showing a portion of an electronic organ mechanism embodying the features of the invention.

Fig. 2 is a schematic circuit diagram showing a portion of the mechanism of Figure 1 showing further features of the invention.

In both pipe organs and electronic organs it has been standard practise to employ means to electrically couple octaves together so the player could strike both the unison note and the note one octave higher in combination from the unison key. In some of the larger instruments a number of both octaves and other desirable note combinations could be played from the unison note by means of either a selective switching device, commonly referred to as a unit coupler, or a multi-point switch contact arrangement co-acting with suitable gang switches.

The switching mechanism embodying the features of the invention was primarily designed for very small electronic organs where space and low cost are prime factors. It provides key contact means for keying a suitable tone generating source and selective means of electrically coupling this source to a tone generating source one octave higher in frequency.

Referring to the drawing, a standard organ keyboard having sixty-one playing keys may be considered to be represented for purposes of illustration. In Fig. 1, for simplicity, only two playing keys and two sets of switch contacts, one for each playing key, are shown. For illustrative purposes a portion of one element 5 is completely cut away and another element 6 is likewise shown cut away in the middle. In Fig. 2 only six playing keys and switch groups are shown. Also the playing keys are shown reversed from the way they would normally be positioned with respect to the contact rods. This is done also for illustrative purposes.

Referring particularly to Fig. 1 the rod contacts 1, 2, 3 and 4 are securely held in place in a laterally extending center contact rod support member 5 consisting of bottom portion or strip 6 and top portion or strip 7. The

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support member 5 can be made of any suitable rigid non-conductive material such as styrene which I prefer as it is easy to machine and cement. The contact rods 1, 2, 3 and 4 are made of hard drawn sterling silver and are .018 in diameter.

For each contact rod 1, 2, 3 and 4 there is provided in the bottom strip 6 a plurality of spaced parallel slots 8 which are about .016 in depth and width. The slots 8 can be either machined or pressed into the strip 6 or formed therein by other suitable means. The strip 6 including the slots 8, one set of slots for each contact rod set associated with each playing key 9 and contact blade 10, is placed in a suitable assembly fixture, not shown, having receptacles for member 6 and contact rods 1, 2, 3 and 4. The said contact rods are placed in said receptacles which properly locate and center them. An application of suitable cement is applied along the face 11 of member 6 and over the contact rods 1, 2, 3 and 4 which are laying across the top of slots 8.

Top member 7 receives a coating of cement along its inner face and it is placed in the assembly fixture with the side that has the cement coating facing the contact rods 1, 2, 3 and 4. The closing of the fixture exerts enough pressure to bring members 6 and 7 together and said contact rods are driven into the slots 8.

The method of securing the contact rods into the support member that has just been described is only one way in which the switch can be constructed. It is possible to utilize molded construction or any other suitable means of securing the rods. It is understood that it is practical to make up the switches in individual sections for each playing key or in gangs for a number of keys or in one unit for a complete set of keys.

Each playing key 9 has secured to it a contact blade 10 which has a sterling silver insert or contact 12 along the contact edge wide enough to bridge the first three rods. The contact rods 1, 2 and 3 protrude towards the contact blade 10 and are about 1½ inches in length on the blade 10 side. The contact rod 1 has the right-angle bend solder connection terminal 15 on the side of member 5 away from the contact blade 10. To clarify the description the contact blade side of the contact rods to the rear of the support 5 as viewed in the drawing, will be referred to as the rear 13 side and the other side of the support 5 will be referred to as the front side. Rod 2 has a right-angle solder connection terminal 16 on the front side of the member 5. Rod 3 is one continuous rod and extends both rearward, in the direction of the arrowed line 13 and frontward, in the direction of the arrowed line 14 from member 5. Rod 4 extends to the front side of member 5 and the end is bent at right angles to formulate a contact 17. The rear end of rod 4 is bent at right angles to form the solder connection terminal 18.

The front end of rod 3 passes thru a hole or opening 19 in a laterally extending actuating member or bar 20 and protrudes out of the hole 19 about 3/16 inch. The member 20 is movable longitudinally, that is, laterally of the mechanism and is normally held against a stop 21 by a spring 22. The left (as viewed in the drawing) end 23 of a right-angle lever 24, is normally held against a fixed stop 25 by an expansion toggle spring 26 which is held in place between the right end 27 of the lever 24 and a fixed spring support 28 by any suitable means not shown. Lever 24 is pivoted on a vertical pivot pin 29 and a vertical pin 31 on a lever arm extension 30 on the lever 24 is normally engaged with a frontally projecting pin 32 which is secured to the member 20.

The member 20 can be made of any suitable rigid non-conducting material preferably styrene. Fixed guides 33 are provided to hold member 20 in its proper position and still allow it to move laterally towards and

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away from stop 21 in directions indicated by the arrowed lines 34 and 35. A stop control tablet 36, usually mounted on the instrument control panel is pivoted intermediate between its ends on a horizontal pivot pin 37 and is connected to the arm 24 at a point 38 thru near the left end connecting rod 39.

When hand pressure is exerted near the top at point 40 on the stop tablet 36 it will cause the tablet 36 to move inward and the bottom 41 outward on the pivot pin 37. Rod 39 attached to the inner or rear side of tablet 36 near the top will exert pressure on lever 24 near the end 23 causing said end to move away from stop 25. At the same time the arm 30 of lever 24 moves to the right in the direction as indicated by the arrow 34. Pin 31 likewise moves in the same direction as it is attached to arm 30 and pin 31 causes member 20 to move also in the same direction to the right. During this time the right end 27 of lever 24 has been moving in a forward or in the direction of the arrow 14 causing spring 26 to be compressed. When a point of dead center is reached the toggle spring 26 is at maximum compression and exerts enough pressure to overcome all friction in the system and will cause the rear of the left end 23 of lever 24 to come to a condition of rest against the stop 21. Just after lever end 27 passed dead center the bar 20 has moved in the direction 34 far enough to cause one (left) contact rod 3 to make contact with one (left) rod 4 at point 42 which is about in the center of the right angle portion 17 of rod 4. The continuing movement of member 20 causes a wiping action to take place between rods 3 and 4 at 42 until member 20 stops moving. The tension of spring 26 is considerably greater than spring 22. Spring 22 is only employed to assist in restoring member 20 to its normal position against stop 21. The rigidity in contact rods 3 and 4 also helps in this regard. Spring 26 has enough tension to cause lever 24 and rod 39 to hold stop tablet 36 in an on position and will likewise thru the linkage described hold rods 3 and 4 in contact without hand pressure on tablet 36.

When pressure is exerted on tablet 36 at 41 the direct reverse procedure occurs, the contact between pins 3 and 4 is broken and member 20 is guided back against stop 21 by guides 33 under the retracting action of the spring 22.

Reference is now made to Fig. 2 in addition to Fig. 1. Fig. 2 is a diagrammatic illustration of the C notes that might be part of a standard 61 note keyboard of an electronic organ. In each instance like parts carry the same numerical designation in both Fig. 1 and Fig. 2. The RC filter and timing circuit shown in Fig. 2 and comprising for each key, the resistors 44 and 45 and the capacitor 46 constitutes a type I desire to employ in connection with a plate-keyed oscillator system which would be used in this type organ for tone generation. When reference is made hereinafter to all notes it means the six notes C₁, C₂, C₃, C₄, C₅ and C₆ and all the rest of the notes of the musical instrument.

The solder connection terminal end of the contact rods 1 of all notes are connected to a positive operating voltage supply 43. The solder terminal 16 of each rod 2 is connected to resistor 44 which in turn is connected to a resistor 45. The other end of resistor 45 is connected to an oscillator keying circuit conductor 49 which terminates at the anode of the appropriate oscillator (not shown). The capacitor 46 is connected between the junction of resistors 44 and 45 and ground buss 47. The solder connection end 18 of rod 4 of note C₁ is connected thru conductor 48 to the solder contact end 16 of note C₂. As will be seen from Fig. 2 point 18 of note C₂ is connected thru a second conductor 48 to point 16 of note C₃. All notes are connected in a similar manner until the last octave is reached when the last note that is connected in this manner would be C₅ in a 61 note organ or C₆ in a 73 note instrument and so on.

When only the unison note is to be played the tablet

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36 is left in the off position as indicated in Fig. 1. A key 9 is depressed allowing current from the supply bus 43 to flow from rod 1 thru strip 12 to rod 2. Positive voltage is available on rod 3 as strip 12 makes contact with it. Current will not flow thru rod 3 as the contact at 17 is open. Current flows thru rod 2, resistors 44 and 45 and keying circuit 49 to the oscillator tube anode (not shown). The capacitor 46 regulates the oscillator attack time as the oscillator will not start oscillating until the capacitor 46 reaches at least a partial point of charge. All notes are connected in a like manner.

When it is desired both the unison note and a note an octave higher be played together from the unison note the tablet 36 is pushed on causing all rods 3 and 4 to make contact at 17. It has been mentioned, when key 9 is depressed rod 3 is energized with a positive operating potential. Positive current now flows from rod 3 to rod 4 at 17 then thru conductor 48 to solder contact end 16 of the note one octave higher than the note of the key depressed. The current continues to flow thru the resistors 44 and 45 to the plate of the oscillator tube. Now two oscillators an octave apart are being energized. It is entirely practical to connect conductor 48 to any desired oscillator so a combination other than the unison and the note an octave higher can be played from the unison note.

It should be apparent to anyone skilled in the art that the device as described minimizes the number of solder connections that would be required to connect it into a suitable electronic situation. This is mainly brought about by one end of contact rod 3 being common to the key contact blade 10 and the opposite end forming part of the octave coupler switch.

The RC filter comprising resistors 44 and 45 and capacitor 46 should be as near the switch contact rods as possible as key click trouble can be experienced if there is an appreciable length of conductor between said resistors and rod end 16. As there are many ways in which the resistors 44 and 45 and capacitor 46 can be mounted it is not felt necessary to give details regarding this feature.

While I have shown and described a preferred embodiment of my invention it will be understood that various modifications and changes will occur to those skilled in the art without departing from the spirit and scope of the invention therefore I contemplate by the appended claims to include any such modification as fall within the true spirit and scope of my invention.

I claim:

1. In an organ key switching and octave coupling mechanism the combination comprising a plurality of electronic oscillator keying circuits, a common ground bus for said circuits, an operating voltage supply bus for said circuits, a fixed non-conductive central switch-contact support member extending laterally of said mechanism, a plurality of spaced parallel contact rods secured to said support member to extend therefrom in a frontward and rearward direction and arranged in group formation along said support member, each group comprising a first rod having a contact portion extending rearward from said support member and a connection at the opposite side of said member with said voltage supply bus, a second contact rod having a contact portion extending rearward from said support member and a connection at the opposite side of said member with one of said electronic oscillator keying circuits, a third rod having contact portions extending both rearward and frontward from said support member, a fourth contact rod extending frontward from said support member and having a connection at the opposite side of said member with a second electronic oscillator keying circuit for one octave higher in frequency than said one keying circuit, a manually operable and laterally movable member attached to the forward ends of all said third rods to move said rods in unison into contact with the forward ends of said fourth rods, a plu-

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ality of playing keys each having a group of contact rods individual thereto and a contact blade positioned for bridging the first three rods of said group in response to operation of said key, means moving said actuating member and said third rods to cause contact to be made between said third and fourth rods of each group to complete circuits from said operating voltage supply bus to one of said oscillator keying circuits and a second of said keying circuits one octave thereabove in response to operation of each key to move said contact blade into contact with the rearward contact portions of said first, second and third contact rods.

2. A key switching and octave coupling mechanism according to claim 1 in which said central support member comprises a top and a bottom portion including preformed contact rod grooves in said bottom portion.

3. A key switching and octave coupling mechanism according to claim 1 in which said central body support member comprises a top portion joined to a bottom portion with cement compatible with both of said members.

4. In an organ key switching and octave coupling mechanism a key switching unit including, an operating voltage

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supply circuit, a plurality of oscillator keying filters, a playing key actuated contact blade, a fixed support member of non-conducting material, a first contact rod secured to said member and connected to said voltage supply circuit, a second contact rod secured to said member in spaced parallel relation to the first rod and connected to one of said keying filters, a third contact rod in spaced parallel relation to said second rod and having a free end common to said contact blade and said first and second rods, a fourth contact rod secured to said member in spaced parallel relation to the third rod and connected to an oscillatory keying filter one octave higher than said first mentioned filter, and manually operable means connected to move said third and fourth contact rods into contact with each other to complete an octave coupling circuit.

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