

April 5, 1960

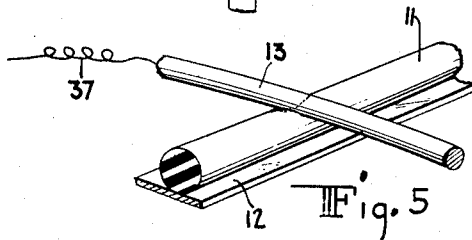
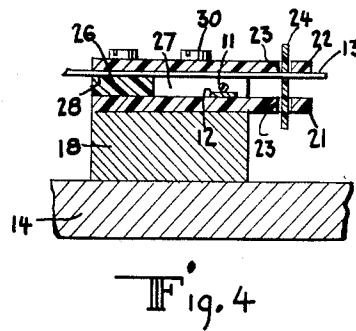
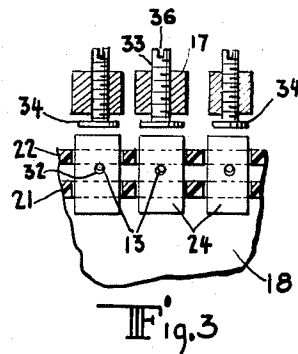
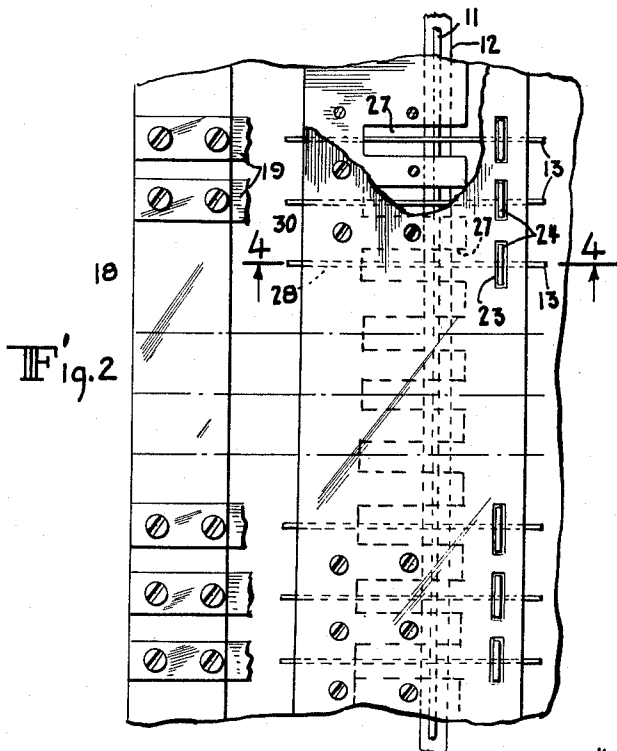
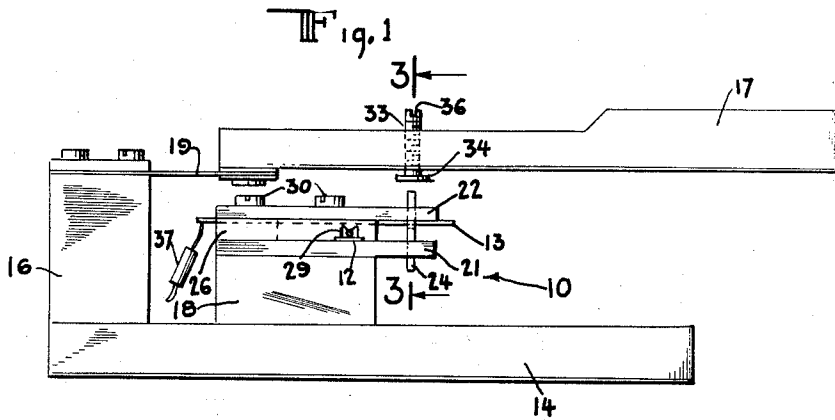
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2,931,877

ELECTRICAL CONTACT DEVICE

Filed Feb. 20, 1958

2 Sheets-Sheet 1



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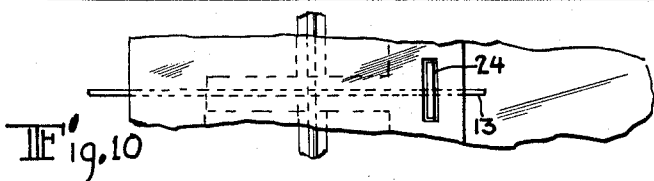
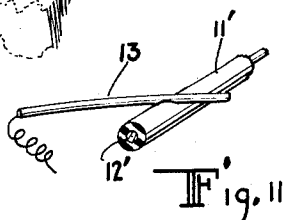
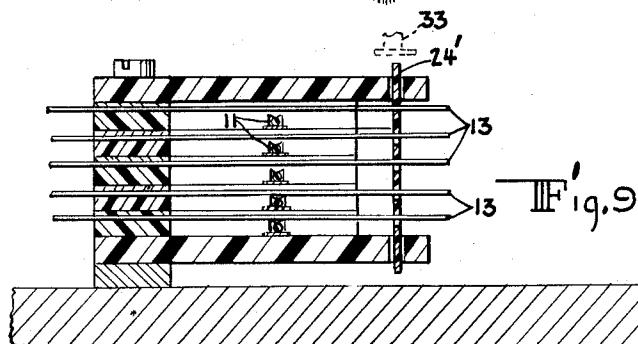
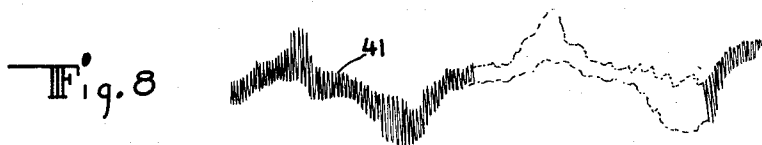
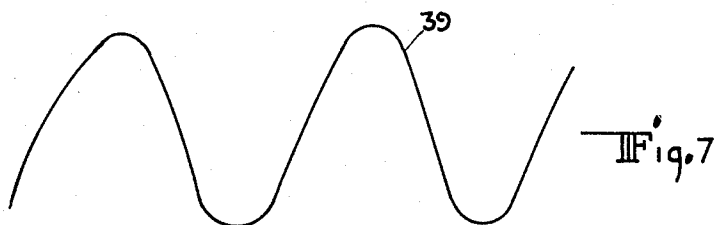
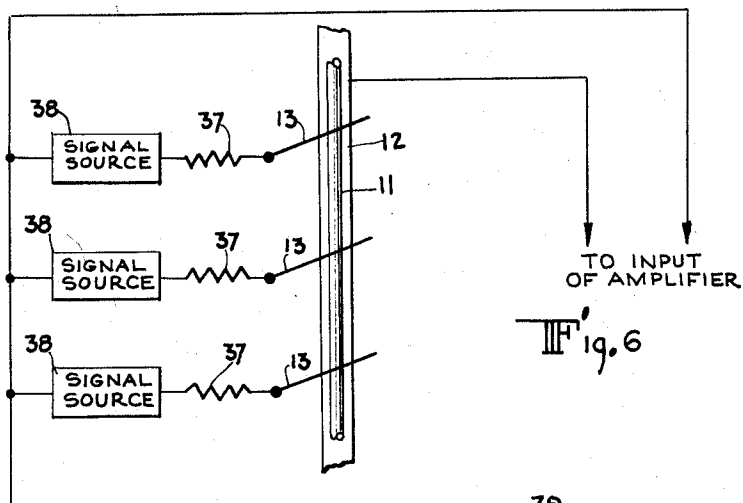
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ELECTRICAL CONTACT DEVICE

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ELECTRICAL CONTACT DEVICE

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3 Claims. (Cl. 200—166)

My invention relates to electronic organs, particularly of the type wherein individual tone sources are connected to amplifier and reproducing means by key actuated switches, and has for its primary object to provide an improved electrical contact for said switches.

It is another object of my invention to provide an electrical contact which generates transient and random noise voltages upon initial closure thereof, such transient voltages diminishing as the closure pressure increases.

It is still another object of my invention to provide an electrical contact having a high impedance compared to the tone source impedance at the moment of initial closure and having a low impedance compared to the tone source at full closure.

It is yet another object of my invention to provide an electrical contact having a large change in resistance with relatively small motion of either contact element.

It is a further object of my invention to provide an electrical contact which is adaptable to economical construction of a contact system wherein a plurality of tone sources is connected through electrical contacts of my invention to common bus bars.

It is still a further object of my invention to provide an electrical contact which is durable in construction, economical in manufacture and reliable in service.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is a side elevational view of a contact assembly of my invention utilizing a single bus bar;

Fig. 2 is a partial top plan view of the assembly shown in Fig. 1 with the playing key removed;

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1 in the direction of the arrows;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 2 in the direction of the arrows;

Fig. 5 is an enlarged, perspective view showing a contact finger in operative contact engagement with its associated bus bar illustrating the enlarged surface contact area following the initial contact;

Fig. 6 is a schematic view of a circuit including the elements shown in Fig. 1;

Fig. 7 is a typical signal of a tone generator or signal source;

Fig. 8 is a curve illustrating introduction of transient noise voltages as initial contact of the finger upon the bus bar is established;

Fig. 9 is a sectional view showing a contact assembly with a plurality of associated contact fingers and bus bars;

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Fig. 10 is a partial top plan view of a portion of the assembly of Fig. 9; and

Fig. 11 is a perspective view of another embodiment of a bus bar and associated contact finger.

Referring to the drawings in detail and, more particularly, to Figs. 1 to 4 thereof, there is shown a typical contact assembly 10 with a filament or elastomer 11 of elastically deformable, electrically semi-conductive material interposed between a stationary contact element or bus bar 12 and a movable contact element or finger 13. The filament 11 and the movable contact element 13 have arcuate surfaces, preferably cylindrical, and are shown disposed at right angles with respect to each other to afford a point contact, as at their points of tangency. Since the filament 11 is elastically deformable, the point contact rapidly changes to a contact with substantially greater area, as the finger 13 is depressed against the filament 11. Because of the high resistance and uncertainty of the initial contact, transient electrical fluctuations are introduced into the applied signal and these fluctuations produce a sound similar to the initial hiss of air that occurs when a valve is opened under a pipe in a pipe organ.

I find that the initial hiss characteristic lends character to the tone and simulates musical instruments better than the conventional electrically noiseless, progressive contact means, such as that shown, for example, in Mork Patent 2,575,230. Also, my contact arrangement provides means for closing an electric circuit in a manner which is neither instantaneous nor sluggish, as in said Mork patented arrangement.

Referring again to Figs. 1 to 4, the contact assembly 10 comprises a base 14 on which are shown a mounting block 16 for a playing key 17 and a mounting block 18 for a pile-up of the fingers, filaments, etc., as will appear hereinafter. A resilient element or flat spring 19 interconnects the mounting block 16 and the playing key 17.

Upon the upper surface of the mounting block 18 is shown disposed a pile-up of three insulating strips, a lower strip 21 and an upper strip 22 that overhang the block 18, as shown in Fig. 1. Each of these strips has a slot 23 (Figs. 2 and 4) in the overhanging portion for registration and guidance of an actuating element 24. The third strip 26 is shorter in depth than the other two strips and has its front edge flush with the face of the block 18. An opening 27 is formed in the central, front portion of the strip 26 to provide for vertical movement of the contact finger 13 by the actuating element 24. The third strip 26 also has a transverse groove 28 upon its upper surface and a longitudinal groove 29 upon its lower surface for registration and securement of the finger 13 and filament 11, respectively. The longitudinal groove 29 is preferably formed in the shape of an M with the middle point thereof contacting the filament 11 and with the spaces at each side of the point adapted to receive expanded portions of the filament upon compression thereof during assembly in order to maintain the filament in contact with the bus 12. To the upper surface of the lower strip 21 is affixed the stationary contact or bus bar 12, in a recess, so that its upper surface is flush with that of the strip 21; or the bus 12 may be preferably etched onto the strip 21 by conventional means. The three insulating strips and block 18 are fastened together to the base 14 by screws 30 in the usual manner.

As seen particularly in Figs. 3 and 4, the finger 13 passes through an opening 32 in the actuating element 24, whereby downward movement thereof, produced by the key 17, will lower and cause the finger to press against the filament 11. Upon release of the key, the resiliency of the finger will retract the actuating element 24 to its normally raised position above and separated from the filament. The playing key 17 is shown pro-

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vided with a set screw 33 having a head 34 at its lower end for engagement with the actuating element 24. A slot 36 at the upper end of the screw 33 for engagement by a screw driver enables the contact travel and pressure of the finger to be adjusted as required.

To the left end of the contact finger 13, as viewed in Fig. 1, is connected one terminal of a resistor 37, the other terminal of the resistor being connected to a signal source 38 and thence (Fig. 6) to one side of the input of an amplifier (not shown). This resistor 37 represents the impedance of an associated electric circuit or can be used to build out the impedance of the associated circuit to the desired value. However, it is within the contemplation of my invention to employ a filament or elastomer 11 having sufficient resistance to effectively determine the total circuit impedance. It will be noted in Fig. 6 that the bus 12 is connected to the other side of the input of the amplifier.

In operation, upon depression of the playing key 17 the actuating element 24 is lowered by the head 34 of the set screw 33 to in turn depress the finger 13 into initial, point contact with the elastomer 11. Prior to this contact and, while the finger 13 and elastomer 11 are separated from each other, the tone from source 38 may be represented by a sinusoidal curve 39 shown in Fig. 7. Upon said point contact the transient noise voltage produces at the bus 12 the modified tone from the source 38 represented by the curve 41, shown in Fig. 8, wherein it will be noted that the amplitudes of the sinusoidal curve 39 have been substantially reduced by the high, initial resistance value of the point contact. As the depression of the key 17 continues, see Fig. 5, the resistance of the larger area contact between the finger 13 and the elastomer 11 drops to produce the desired, final tone.

As a modification, the elastomer 11 and bus 12 may be combined into the form of a cable, as seen in Fig. 11. Here, a bus 12' is shown as a central conductor surrounded by an elastomer 11'. The operation of this modification is similar to that heretofore described, from the initial contact to the depressed contact of finger 13.

At this point it may be mentioned that the elastomer 11 may be constituted by any of a number of commercially available natural or synthetic rubber compounds having an electrical resistance in the order of 100 to 200 ohm-centimeters. The contact finger 13 is preferably .012 to .015 inch in diameter of Phosphor bronze wire plated with a corrosion resisting metal, such as gold. The metallic bus 12 or central conductor 12' may be of tinned copper while the three insulating strips 21, 22, 26 and actuating element 24 may be of phenol fiber.

For most satisfactory operation the impedance of the source 38 is about 100,000 ohms. At the moment of initial contact by the finger 13 upon the filament or elastomer 11, the contact resistance is about one megohm or more. As the actuating element 24 is depressed further, the elastomer is deformed by the finger 13 to increase the contact area therebetween and thus decrease this resistance to a few thousand ohms.

From the foregoing description it will be seen that my

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invention provides an improved electrical contact for switches particularly adaptable for use in electronic organs. While only a single contact arrangement of finger 13 and elastomer 11 has been described in the foregoing, it is, of course, required that a plurality of such contact arrangements be operable by a single actuating element 24 in order to obtain the desired tones. Such a multiple arrangement is shown in Figs. 9 and 10, wherein the actuating element 24' is adapted for simultaneously moving a plurality of fingers 13 into contact with associated elastomers 11, arranged in superposed relationship.

As various changes may be made in the form, construction, and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

1. An electrical contact device comprising a stationary, elongated metallic contact element, a movable, elongated metallic contact element having an arcuate surface, and an elongated, elastically deformable, electrically semi-conductive member having an arcuate surface interposed between said contact elements in linear relationship to said stationary contact element, said movable contact element and said semi-conductive member being disposed at right angles with respect to each other and said movable contact element being adapted to engage said semi-conductive member to establish a circuit connection between said movable contact element and said stationary contact element.

2. An electrical contact device in accordance with claim 1, wherein said movable contact and said semi-conductive member are each circular in cross section.

3. An electrical contact device in accordance with claim 1, wherein said stationary, metallic contact element and said semi-conductive member are formed as a cable with the stationary, metallic contact element constituting a core thereof and the semi-conductive member as the surrounding material around the core.

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