July 11, 1967 H. G. BAUER 3,330,916

BIMETALLIC CONTACT ELEMENT FOR ELECTRONIC MUSICAL INSTRUMENT

Original Filed Oct. 26, 1960

Fig. 1.

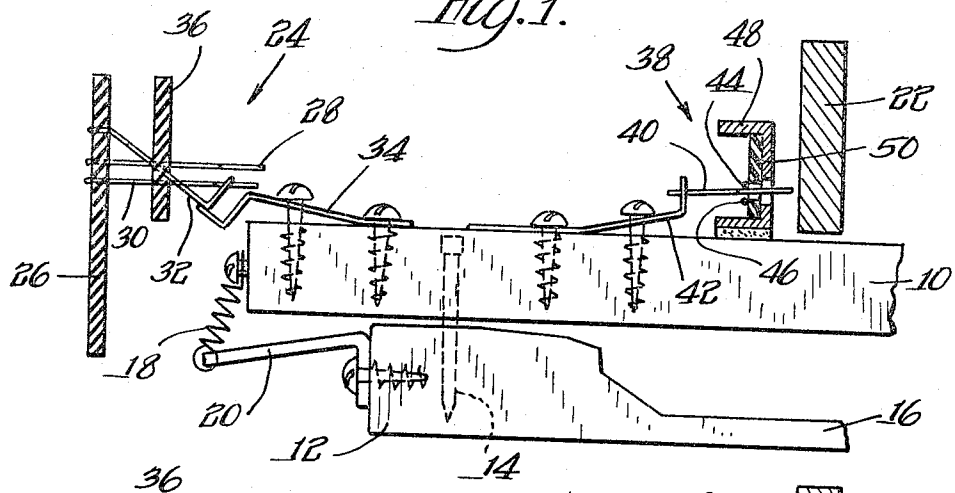


Fig. 2.

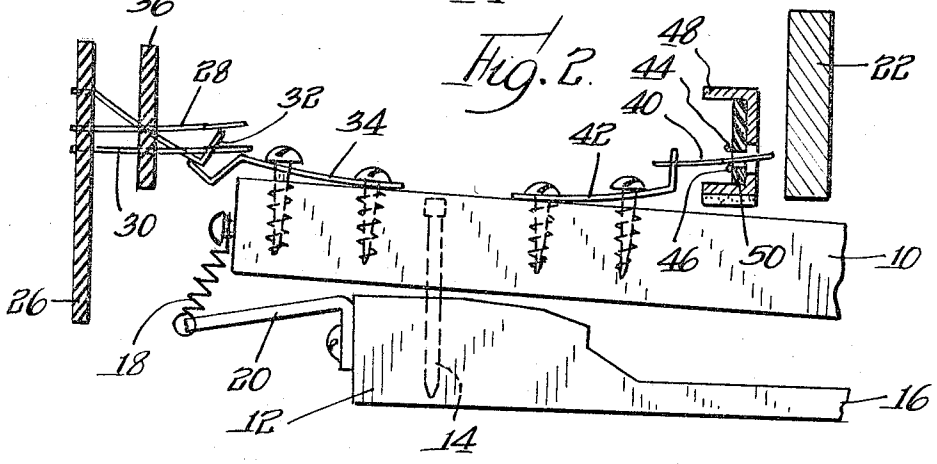


Fig. 3.

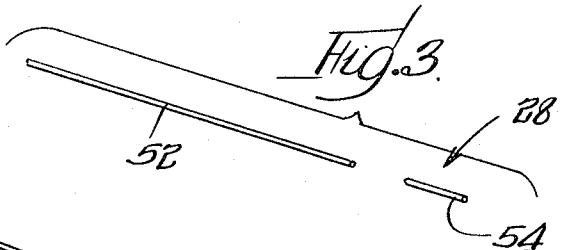
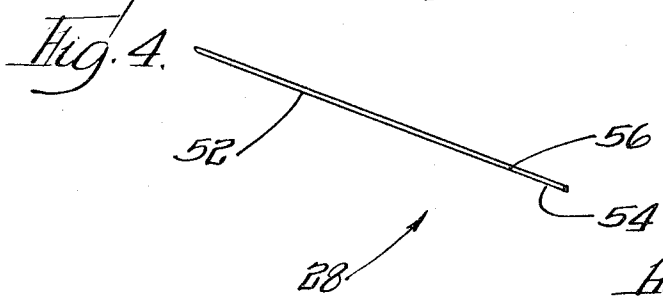


Fig. 4.



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BIMETALLIC CONTACT ELEMENT FOR ELECTRONIC MUSICAL INSTRUMENT

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8 Claims. (Cl. 200—5)

ABSTRACT OF THE DISCLOSURE

A switch for electronic musical instruments wherein the switch includes fixed and movable whisker-like contacts one of which is bimetal with a material of high flexural strength along a major portion thereof and with a contact portion of a material having high resistance to arcing and oxidation.

This application is a continuation of my prior application, Ser. No. 65,076, filed Oct. 26, 1960, now abandoned.

This invention relates generally to electronic musical instruments and especially to components for use in the electrical switches which are operated by the note sounding keys of such instruments.

In order to conserve space and in order to obtain relatively uncomplicated assemblies, the electrical contact elements used in electronic musical instruments commonly comprise simple sections of conductive wire, sometimes straight, sometimes configurated. Ordinarily, these wire or whisker-type contact elements are flexed longitudinally when engaging or engaged by other contact elements; and as is the case with any electrical contact elements, the wire contact elements of electronic musical instruments are subjected to electrical stresses upon the making or breaking of electrical contact.

Unfortunately, those materials displaying good resistance to arcing and to oxidation are not characterized by high flexural strength, and vice versa. Hence, the whisker-type contact elements heretofore used in electronic musical instruments have been beset with problems arising from flexural fatigue failure or from damage due to arcing.

Accordingly, a general object of the present invention is to provide a new and improved contact element for electronic musical instruments.

Another object of the invention is to provide an electrical contact element of the type described which combines high flexural strength with good resistance to arcing and oxidation.

Yet another object of the invention is to provide an inexpensive, electrical contact element having long and useful service life in an electronic musical instrument.

Additional objects and features of the invention pertain to the particular structure, materials and arrangements whereby the above objects are attained.

A structure in accord with the invention includes a flexurally strong, conductive wire adapted to be secured at one end to a mounting means incorporated in an electronic musical instrument; and a conductive wire of contact metal fixed in substantially coaxial relationship to the free end of the flexurally strong wire to define a contact element adapted to be engaged by another contact element.

The invention, both to its structure and mode of operation, will be better understood by reference to the following disclosure and drawing forming a part thereof, wherein:

FIG. 1 is a side elevational view in partial cross-section of an electronic musical instrument keyboard incorporating a switch arrangement which employs contact elements constructed in accordance with the invention, the switch arrangement being illustrated in its normal or rest position, the section being taken along a central plane drawn through the electronic musical instrument;

FIG. 2 is a side elevational view taken along the same section used for FIG. 1 and being similar to the showing of FIG. 1 but illustrating the switch arrangement in its operating position;

FIG. 3 is an exploded and enlarged perspective view of the parts making up the contact element of the invention; and

FIG. 4 is an enlarged perspective view of an assembled contact element in accordance with the invention.

Referring now in detail to the drawing, especially to FIGS. 1 and 2, an electronic musical instrument key **10** of conventional construction is shown pivotally mounted to a balance rail **12** by means of a balance rail pin **14**. The balance rail **12** is integrally joined to a keybed **16** that extends across the body of the electronic musical instrument. Advantageously, the keyboard end of key **10** is biased in a vertically upward direction by means of a tension spring **18** which is disposed between a bracket **20** that is secured to the rearward end of balance rail **12** and the rearward end of key **10**.

In compliance with customary practice, a front plate **22** extends across the keyboard of the electronic musical instrument; and behind the plate **22** are disposed a number of electrical switches, each of the operating keys **10** being arranged with two or more of these switches. As shown, a switch arrangement indication generally by the numeral **24** is arranged with a circuit board **26** that provides electrical connections such as to the amplifiers and continuously operating oscillators customarily incorporated in an electronic musical instrument.

The switch **24** comprises an upper fixed contact **28**, a lower fixed contact **30** and a movable contact **32**, each of the contacts **28**, **30** and **32** being mounted to the circuit board **26** and electrically connected to appropriate portions of the circuit carried thereby. A switch arm **34** is mounted to the key **10** in order to facilitate relocation of the movable contact **32** upon depression of the key. In addition, a suitably slotted guideboard **36** may be provided for establishing and maintaining proper positional relationship between the contacts **28**, **30** and **32**.

In somewhat similar manner, a switch arrangement indicated generally by the numeral **38** is situated generally between the front plate **22** and the switch arrangement **24**, switch arrangement **38** being arranged for actuation of the percussion effects of the musical instrument notes if such effects are desirably incorporated. In the switch arrangement **38**, a contact element **40** is affixed to a switch arm **42**, the switch arm **42** being, in turn, affixed to the key **10**. A pair of elongated, spaced-apart conductors **44** and **46** are mounted sandwiching the contact element **40**, conductors **44** and **46** being specifically mounted to a channel element **48** by means of an insulating strip **50**.

It is important to point out that the contact elements **28**, **30** and **40** are straight wire or whisker-type contact elements; and as will become apparent from a comparison of FIGS. 1 and 2, the contact elements **28**, **30** and **40** are flexed rather substantially in a longitudinal direction when engaged by the cooperating contact or conductive elements.

In accordance with the present invention, the contact elements **28**, **30** and **40** are similarly constructed; and turning to FIGS. 3 and 4, the construction of contact element **28** will become apparent. There, the contact element **28** will be seen to include a flexurally strong, conductive wire **52** desirably fashioned from an alloy of beryllium and copper. To one end of the wire **52** there

is affixed in substantially coaxial relationship a conductive wire **54** of contact metal, desirably an alloy of silver and platinum. As is particularly well shown in FIG. 4, the wires **52** and **54** are joined together by a butt weld **56**.

In assembly, the free end of wire **52** is employed in mounting the contact element. So assembled, the wire **52** is capable of bearing the mechanical stresses applied to the contact in use, and the wire **54** is capable of bearing the electrical stresses applied to the contact whereby to resist damage due to oxidation and arcing incurred upon the making and breaking of electrical contact.

The contact **32** is advantageously arranged in either L-shape or U-shape in order to present a portion extending at right angles to the contacts **28** and **30**. It is to be recognized that element **32** may be constructed with the flexing portion fashioned from flexurally strong wire such as the wire **52** and having the portion for making contact with the elements **28** and **30** fashioned from contact wire such as the wire **54**.

It is to be generally recognized that the wire used in the contact element **28**, **30**, **32** and **40** is fine wire on the order of 0.016 inch in diameter.

The specific example herein shown and described should be considered as illustrative only. Various changes in structure may occur in those skilled in the art; and such changes are to be understood as forming a part of this invention insofar as they fall within the spirit and scope of the appended claims.

What is claimed is:

1. In a switch arrangement for electronic musical instruments, the combination comprising a pair of mutually engageable contacts with mounting and actuating means therefor and one of the mutually engageable contacts including a two-part contact member including a discrete substantially straight, rod-like body element of electrically conductive and flexurally strong material, said body element having a compartatively substantial length and a comparatively small cross-section whereby to be flexible, the length of said body element being less than the length of the contact required for mutual engagement with the other contact, said one contact member further including a discrete substantially straight, rod-like element of contact alloy metal of the same small cross-section mechanically and electrically affixed to one end of said body element of flexurally strong material in butting coaxial relation thereto to extend the length of said one contact with said element of contact metal into operative position for mutual engagement with the said other contact, relative movement of said one contact between open and closed position causing said body element of flexurally strong material to react flexibly and bear mechanical stresses applied to said one contact, such flexible reaction being operative to change the effective length of said one contact attendant upon the non-linearity produced upon flexing thereof, said element of contact metal bearing electrical stresses applied thereto and having an axial dimension beyond the body element appreciably greater than the transverse dimension thereof whereby to accommodate the axial dimension of the element of contact metal to minor misalignments with the said other contact and effect a wiping mutual engagement therewith as the effective length of said one contact changes upon flexing thereof.

2. In a switch arrangement for an electronic muscial instrument, the combination comprising a plurality of switch assemblies each including cooperating and mutually engageable movable and substantially fixed contacts, mounting means between substantially fixed contacts, control key means carrying the movable contacts,

at least one contact of each assembly comprising a two-part contact member for cooperation with the other contact, said two-part contact member including a discrete substantially straight, rod-like body element of electrical monductive and flexurally strong material, said body element having a comparatively substantial length and a comparatively small cross-section whereby to be flexible, the length of said body element being less than the length of the contact member required for mutual engagement with the said other contact, said contact member further including a discrete substantially straight, rod-like element of contact metal separately affixed to one end of said body element of flexurally strong material to extend the length of said contact member into operative position for mutual engagement with the said other contact, relative movement of said contacts between open and closed positions causing said body element of flexurally strong material to react flexibly and bear mechanical stresses applied to said contact member, such flexible reaction being operative to change the effective length of said contact member attendant upon the non-linearity produced upon flexing thereof, said element of contact metal bearing electrical stresses applied thereto and having an axial dimension beyond the body element appreciably greater than the transverse dimension thereof whereby to accommodate the axial dimension of the element of contact metal to minor misalignments with the said other contact and effect a wiping mutual engagement therewith as the effective length of said contact member changes upon flexing thereof.

3. The combination according to claim **2**, wherein the two-part contact member forms the movable contact.

4. The combination according to claim **2**, wherein the two-part contact member forms the substantially fixed contact.

5. The combination according to claim **2** wherein said flexurally strong material is an alloy of beryllium and copper and wherein said contact metal is an alloy of silver.

6. The combination according to claim **2** wherein said element of flexurally strong material and said element of contact metal are affixed together in substantially coaxial relationship.

7. The combination according to claim **2**, wherein the switch assemblies are arranged in pairs with the two-part contact member forming the movable contact for one pair and with two-part contact member forming the substantially fixed contact of the other pair.

8. The combination according to claim **2**, wherein the rod-like element of contact metal is of the same small cross section as the body element and disposed in butting coaxial relation thereto.

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