

July 31, 1951

M. MARTENOT

2,562,471

KEYBOARD ELECTRIC MUSICAL INSTRUMENT

Filed April 5, 1948.

3 Sheets-Sheet 1

Fig. 1.

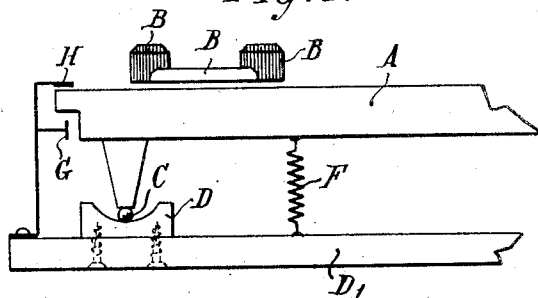


Fig. 2.

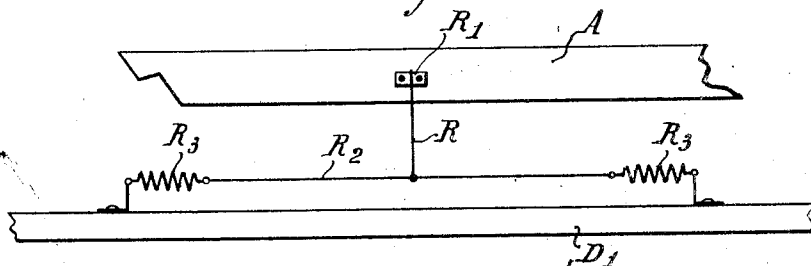


Fig. 3.

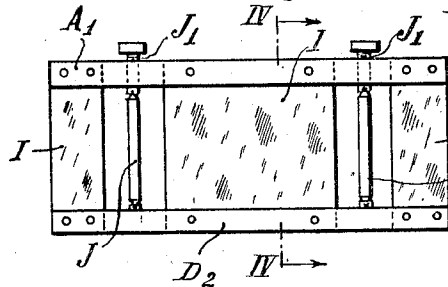


Fig. 4.

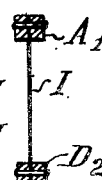
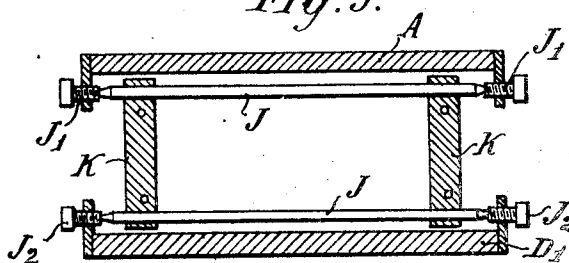


Fig. 5.



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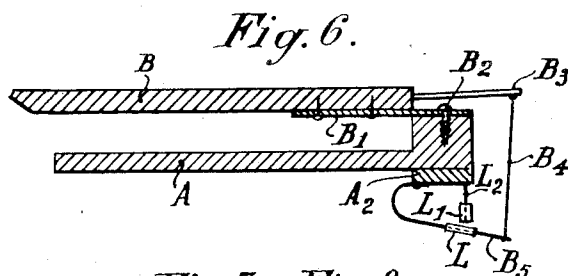


Fig. 7. Fig. 8.

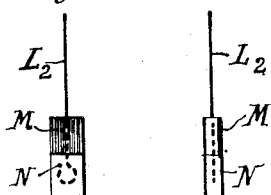


Fig. 9.

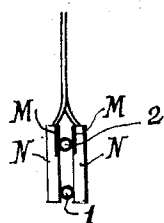


Fig. 10.

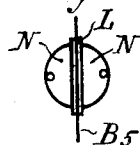
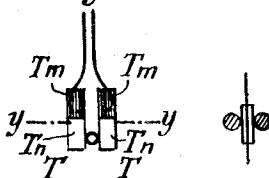


Fig. 11.



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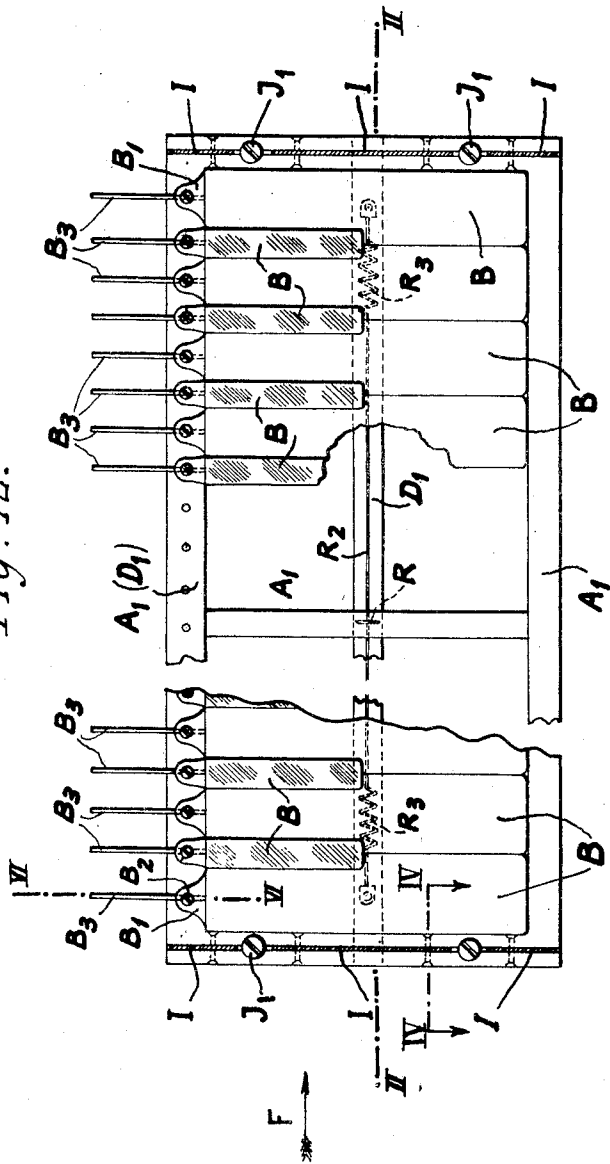
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KEYBOARD ELECTRIC MUSICAL INSTRUMENT

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Fig. 12.



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KEYBOARD ELECTRIC MUSICAL
INSTRUMENT

Maurice Martenot, Neuilly-sur-Seine, France

Application April 5, 1948, Serial No. 19,123
In France April 14, 1947

10 Claims. (Cl. 84-423)

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This invention relates to improvements in keyboard electric musical instruments, i. e. those in which the electric circuits generating the various sound frequencies are controlled by keys on which the performer plays as he would do on the finger-keys of a piano, for example.

There is already known for such instruments a movable keyboard device providing sound pitch variations independent of those obtained by means of the keys and allowing, e. g., short glissandi or vibratos corresponding to the manner of playing of the performer.

Since the shifting of the keyboard varies the sound pitch, it is essential that after each of such shiftings the keyboard resumes its original position with a high accuracy, failing which the instrument may fall out of tune perceptibly enough to disturb the performance.

Moreover, in spite of the lightness of the materials used, the keyboard assembly, constitutes a mass which does not easily follow the oscillations required by the hand which are sometimes ample and quick. Therefore the inertia of the mass must be compensated by a device providing a strong restraining action as well as a powerful return or draw back-motion.

One of the improvements to which this invention relates makes it possible to meet the above mentioned requirements. According to said improvement the movable keyboard is associated with means ensuring its return or drawback-motion and guiding it as well, and the drawback means which offer to the keyboard motion a mechanical resistance increasing in terms of the departure on either side of the neutral position, are so designed that the frequency of the keyboard free oscillations has a materially higher value than the vibratos oscillations commonly used during performance.

Another improvement according to the invention and which may be applied separately or simultaneously with the first one relates to the design of the contacts controlled by the keys of the keyboard.

The contacts used heretofore present the disadvantage to be insufficiently reliable, noisy, too heavy and too cumbersome to be used on movable keyboards which require the greatest possible lightness.

In some electrically controlled instruments such as modern organs independent circuits are acted upon for each note, said circuits being fed with current voltages and strengths of such values that slight variations in the quality of the contacts may be neglected.

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Now in the monodic instruments of the electronic type to which this invention is more particularly relative the contacts operated by the keys should control circuits which are sensitive to the slightest variations of resistance. It will be therefore understood that the quality of said contacts should be absolutely perfect. Thus, for example, in the instruments the contacts of which vary the inductance or the resistance of oscillating circuits or of their associated circuits, the contacts operating by a mere pressure have been found inadequate.

According to one improvement which constitutes one object of the invention the movable part of the contact which acts by friction slides along a continuous surface divided into insulating and conducting sectors so that the circuit is open or closed according to the position of the movable part along said surface, on which said part may thus continually rest.

It will be easily understood by reading the following description with reference to the accompanying drawing given as an illustration which does not limit the invention, how it may be embodied, the features resulting from the drawing as well as from the description pertaining, of course, to the scope of said invention. In the drawing:

Fig. 1 is a diagrammatical elevation view of one end of an improved movable keyboard according to the invention. The device is symmetrical with respect to a vertical plane such as indicated at Y—Y.

Fig. 2 is an elevation view of an intermediate part of the keyboard provided with a modified device.

Fig. 3 is an end view of a keyboard showing another modification of the suspension device of said keyboard.

Fig. 4 is a sectional view of Fig. 3 taken along line IV—IV.

Fig. 5 is an end view of a keyboard provided with another modified suspension device.

Fig. 6 is a side view of one key of the keyboard with the associated movable contact.

Fig. 7 is a similar but enlarged view of one of the stationary surfaces with which the movable contact co-operates.

Fig. 8 is a side view of said surface.

Fig. 9 shows as a side view the pair of stationary surfaces and the co-operating movable contact.

Fig. 10 is an underneath plan view of Fig. 9.

Fig. 11 is a view similar to Fig. 9 and showing an alternative embodiment of the contact.

Fig. 12 is a plan view of an embodiment of the invention according to Figs. 2, 3, 4 and 6, Figs. 2 and 6 being sections taken on the lines II—II and VI—VI, respectively, and Fig. 3 being an end view looking in the direction of the arrow F' of Fig. 12.

In the embodiment shown in Fig. 1 keyboard frame A supporting a set of keys B is mounted on rollers C which move along incurved roller-tracks D carried on a stationary base or support D₁. If the keyboard is moved longitudinally (it could be moved transversely by orienting the rollers in the width direction) it will always tend to resume rigorously its original position. Moreover, due to the bending of roller-track D, the more considerable the departure on both sides of the neutral point is the greater the resistance will be.

To make the construction easier, the device may be inverted and the roller tracks may be integral with the movable frame while the rollers will be disposed on a stationary base. There will be provided on the keyboard as many devices of this type as will be necessary for its suitable seating and good operation. They will be conveniently added with one or more springs F' and stops G and H limiting the amplitude of the motion. The rollers may also be substituted by balls suitably mounted or by a pivoting on pin or hinge.

The drawback force exerted by gravity in the roller-tracks D and combined with the action of springs F should ensure a natural frequency of the keyboard higher than the usual vibratos frequencies.

Fig. 2 illustrates another drawback device. It comprises a spring-leaf R secured on one side to a point R₁ of the movable keyboard A, on the other side to a steel wire R₂ tightened between two coil-springs R₃ secured on a stationary frame D₁.

This device may be mechanically inverted, the spring-leaf being then integral with the stationary base and the wire and the coil-springs being secured on the movable keyboard. The strength of the springs should be determined with respect to the mass of the movable keyboard so as to ensure to said keyboard a natural frequency higher than the usual vibratos frequencies which can be manually realized by a musician.

This return and damping mechanism acting on the movable frame A may be associated with supporting devices for the frame, similar to those of Fig. 1 or of Fig. 3 and 4 hereunder described.

According to Figs. 3 and 4 two parts A₁ and D₂, one of which is secured on the movable key-carrying frame, the other one being secured on the stationary support, are interconnected by means of flexible strips I made of metal or of any other material. Point-ended metallic rods J are clamped between two cups, one of which at least J₁ is adjustable to allow an accurate adjustment according to the length of strips C.

Conversely, it is possible to use rods the dished ends of which would be clamped between central point-screws.

A plurality of such devices may be disposed along the length of the keyboard suitably securing said keyboard while ensuring its maximum movableness. Alternatively Fig. 5 shows a device in which rods J are horizontal instead of being vertical. Said rods are interconnected in pairs by means of leaves K. In each pair the upper rod is clamped between adjustable cups J₁

secured on the movable keyboard A while the lower rod is clamped between cups J₂ supported on fixed support D₁. This device might be further modified by securing leaves K at one end on the movable frame, for example, and by linking them at their other end on the stationary support as described above or conversely. In this case leaves K should, of course, be flexible enough.

Fig. 6 shows a general view of the contacting device associated with each key. Frame A of the keyboard seen in section carries a key B secured thereto by means of a spring-leaf B₁ which ensures the drawback motion of the key and is secured on the frame by means of a screw B₂. A rod B₃ integral with the key controls through a wire B₄ the motion of a light spring B₅ secured on a small insulating bar A₂. Near to the end of said spring a tube L, preferably made of noble metal engages the arms of two contacts L₁, also made of noble metal, as soon as key B is depressed. The adjustment of the attack point of the contact is ensured either by twisting rod B₃, or by turning it if it is screwed or merely keyed in the key.

Figs. 7 and 8 show one contact arm L₁ enlarged twice. A steel wire L₂ supports a metallic portion M the extension of which is embedded in a perfectly insulating plastic substance N. Conducting surface M and insulating surface N are adjacent in the same plane.

Fig. 9 shows the metal tube L, which constitutes the movable contact, in its rest position at 1, where it engages the insulator and in its end position at 2, where it rests on the metal. It will be understood that said tube clamped between both contact arms and sliding first on the insulating portion, soon engages the two metallic portions which are continually cleaned by the wiping action which ensures a perfect twin-contact. It will be also understood that such a device is absolutely noiseless and cannot get out of order, the tube being continually guided either by the insulating portion or by the metallic portion of each contact.

The invention comprises various other embodiments, e. g., by substituting for metallic leaf M a thin film of metal deposited by spraying or by electroplating or by shaping movable part L otherwise on by controlling it through any other device than that shown in Fig. 6 as an illustration. It is also possible to shape otherwise the metallic portion and to engage it on its edge instead of engaging it on its face, or to replace the flat surfaces by two rods or tubes T, T one portion of which T_n would be insulating, the other portion T_m being conducting (Fig. 11).

Moreover it is to be understood that the described embodiments have been given merely as illustrations and that they could be modified, particularly by substitution of technical equivalents within the scope of the invention.

What I claim is:

1. In an electrical musical instrument, a stationary support, a frame movably arranged on said support, a set of keys pivotally mounted on said frame, electric contacts on said frame each operatively connected to one of said keys for generating sounds of different frequencies, means for supporting said frame on said support for oscillating movement on either side of a middle position, means between said frame and said support for permanently urging said frame to said middle position, said urging means and said frame forming together an oscillatory body the

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oscillation frequency of which is a function of the strength of said urging means and of the mass of the frame, said strength and mass being so correlated that the said frequency is higher than the frequency of the tremolos which may be manually obtained by a musician.

2. An electric musical instrument according to claim 1 in which said frame-supporting means comprise surfaces, bearing means resting on said surfaces and flexible leaves arranged between the frame and its stationary support.

3. An electric musical instrument according to claim 1 in which said frame-supporting means comprise surfaces, knife-edges resting on said surfaces and flexible leaves arranged between the frame and its stationary support.

4. An electric musical instrument according to claim 1 in which said urging means comprise at least one leaf-spring fixedly secured at one end to said frame, and tie-rods, said leaf spring being linked at its other end with said tie-rods.

5. An electric musical instrument according to claim 1 in which said urging means comprise at least one leaf-spring fixedly secured at one end to said frame, tie-rods linked with said leaf-spring at its other end, and coil-springs controlling said tie-rods.

6. An electric musical instrument according to claim 1 in which said electric contacts comprise a smooth surface constituted by at least one insulating area and one conducting area in the prolongation of the first one and a movable metallic cylinder moving along said surface, said movable member being mechanically connected to the corresponding key.

7. An electric musical instrument according to claim 1 in which said electric contacts comprise a smooth surface constituted by at least one insulating area and at least one conducting area in the prolongation of the first one, said areas being adjacent in the same plane, and a movable metallic cylinder moving along said surface, said cylinder being mechanically connected to the corresponding key.

8. In an electric musical instrument, a sta-

tionary support, a frame movably arranged above said support, a set of keys pivotally mounted on said frame, electric contacts on said frame each operatively connected to one of said keys for generating sounds of different frequencies, a set of vertical rods having sharp ends, said rods being inserted between points of said support and of said frame respectively for supporting said frame on said support while allowing the oscillating motion of said frame with respect to said support on either side of a middle position, and resilient means secured to the support and to the frame for permanently urging said frame to said middle position, said resilient means and said frame forming together an oscillating body the oscillation frequency of which is a function of the strength of said resilient means and of the mass of the frame, said strength and said mass being so correlated that the said frequency is higher than the frequency of the tremolos which may be manually obtained by a musician.

9. The combination of claim 8 comprising further on said frame and on said support adjustable cups receiving the sharp ends of said vertical rods.

10. The combination of claim 8 comprising further on said frame and on said support adjustable cups receiving the sharp ends of said vertical rods, and vertical flexible leaves secured to said support and to said frame in order to maintain said rods in close engagement with said cups.

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