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ELECTRICAL MUSICAL INSTRUMENT

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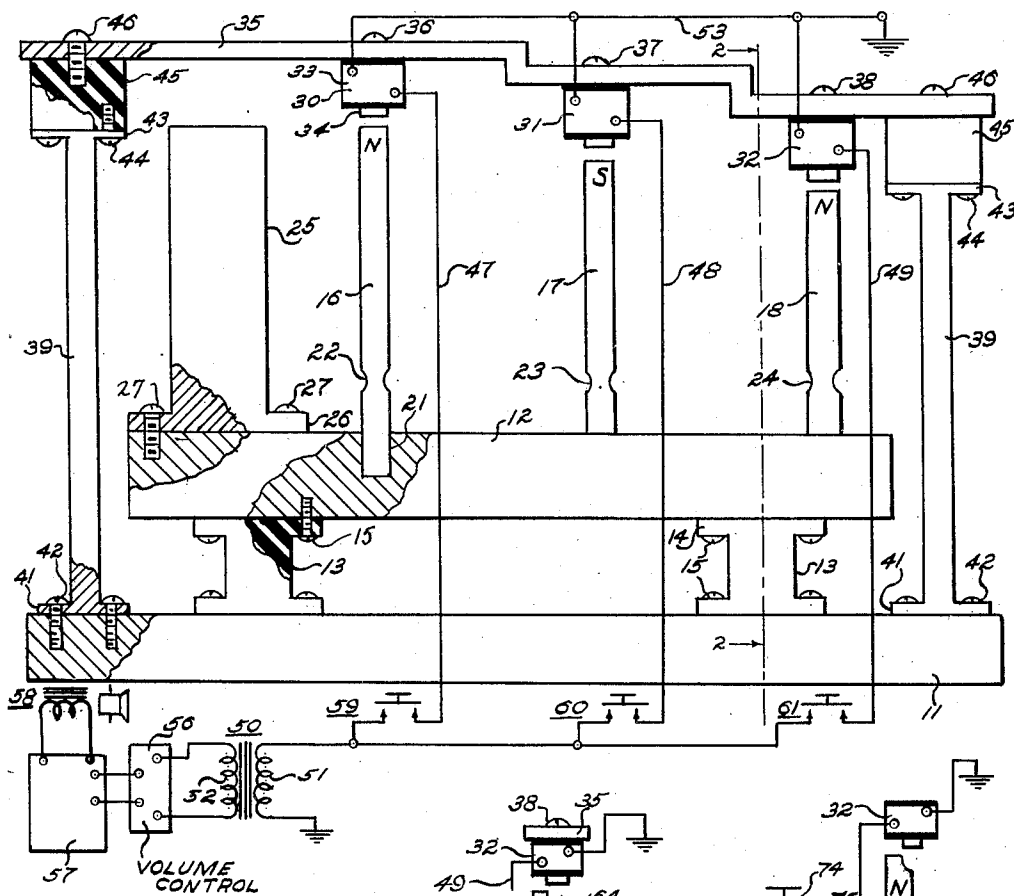


Fig. 1

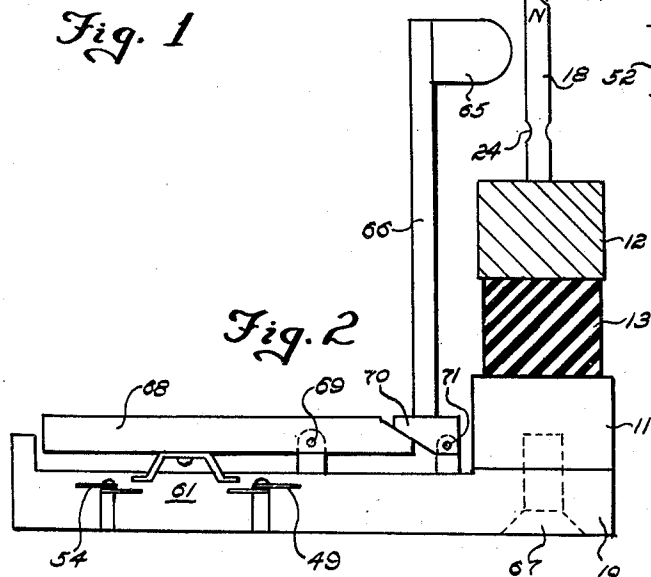


Fig. 2

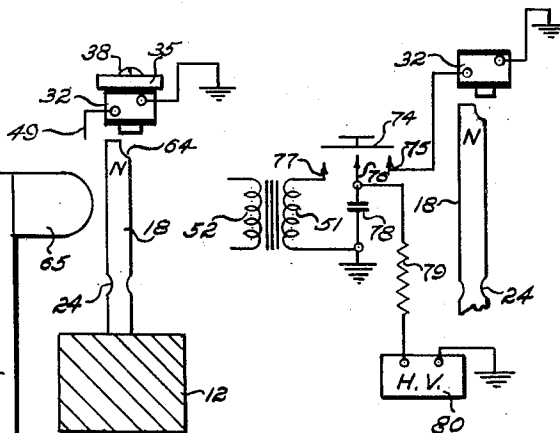


Fig. 3

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ELECTRICAL MUSICAL INSTRUMENT

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My invention relates in general to musical instruments and more particularly to an electrical piano.

An object of my invention is the provision of an electrical piano wherein the frequency for each note of the scale is governed by a vibrating reed having a magnetic pole which vibrates relative to a current generating device which produces the energy for making the musical note.

Another object of my invention is the provision in an electrical piano of maintaining correct frequency for each of the notes of the scale.

Another object of my invention is the provision in an electrical piano of a vibrating reed having a neck portion ground or otherwise dimensioned to produce the correct frequency.

Another object of my invention is the provision of obtaining the correct frequency of the vibrating reed by grinding a neck portion around the vibrating reed to the correct dimension for producing the correct frequency required for each note of the scale.

Another object of my invention is the provision of a plurality of vibrating reeds mounted on a sprung mass having a high Q.

Another object of my invention is the provision of a series of vibrating reeds each having magnetic poles which vibrate in cooperation with inductance elements or current generating coils whereby the frequency of the current generated corresponds to the frequency of the vibrating pole associated therewith.

Another object of my invention is the provision of a series of vibrating reeds having magnetic poles of alternate polarity whereby substantially a closed magnetic circuit is obtained between adjacent vibrating reeds.

Another object of my invention is the provision of vibrating the vibrating reeds either by mechanical impact or by electrical impulses.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 represents a diagrammatic illustration of an electrical piano embodying the features of my invention, parts being omitted for the purpose of clarity;

Figure 2 is a cross-sectional view of my electrical piano taken along the line 2-2 of Figure 1, parts being omitted for clarity; and

Figure 3 is a fragmentary view showing a

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single vibrating reed and an electrical impulse method for vibrating the reed.

With reference to the drawing, and particularly to Figures 1 and 2, my invention comprises generally a base 10, a support member 11 securely mounted on the base 10, a sprung mass 12 in the form of a cross-bar upon which are mounted a plurality of vibrating reeds 13, 17 and 18 having their free ends vibrating relative to current generating devices 30, 31 and 32, respectively. The current generated respectively in the current generating devices is respectively conducted to a transformer 50 which is in turn connected to a volume control unit 55 and an amplifying circuit 57 which provides amplified energy for the dynamic speaker 52 that produces the musical note which corresponds respectively to the current generated in the current generating devices. While I have illustrated three vibrating reeds and three current generating devices, it is clearly understood that in the practical application of my invention I provide a vibrating reed and an associated current generating device for each note of the scale, whereby a complete piano scale may be provided or a fractional part thereof as requirements demand.

The base 10 may extend laterally for a distance to include all of the keys of the piano scale. As shown in Figure 2, the keys, that is the elements which the fingers touch when playing the piano, are indicated by the reference character 63. As illustrated, the keys 63 may be pivotally mounted at a pivot point 69 which when the keys are depressed causes the hammer 65 to strike its associated vibrating reed. The hammer 65 may be carried by an arm 62 which is attached to a pivot block 76 adapted to pivot around a pivot point 71. Mounted underneath each key is a contactor which in Figure 2 is identified by the reference character 61 and is adapted to close a circuit for connecting its associated current generating device with the primary winding 51 of the transformer 50. The contactors mounted under each of the keys are constructed of resilient material so that the finger touch of the playing of the keys is not interfered with. Mounted along the rear side of the base 10 is a support member 11 which extends for the full length of the key board. The support 11 may be mounted to the base 10 by means of the illustrated screws 67. The sprung mass 12 comprises a cross-bar upon which the vibrating reeds are mounted and may be supported above the support member 11 by

means of a plurality of rubber supporting blocks 13. The rubber supporting blocks 13 are provided with laterally extending flanges 14 whereby the blocks may be anchored to both the support member 11 and the sprung mass 12 by means of screws 15 extending through the flanges. The vibrating reeds 16, 17 and 18 are firmly and securely mounted in holes provided in the upper side of the sprung mass bar 12, the hole for the reed 16 being identified by the reference character 21. Mounted on the sprung mass bar 12 is a stabilizing body or mass 25 which has flanges 26 whereby the body or mass may be anchored to the cross-bar mass 12 by means of screws 27 extending through the flanges 26. One function of the stabilizing body of mass 25 is to keep the sprung mass bar 12 relatively stable when the vibrating reeds are struck by the hammers 65 when the piano is being played. The provision of the rubber support mounting for the sprung mass cross-bar 12, taken together with the mass of the stabilizing body 25, produces a support for the vibrating reeds having a high Q. In other words, the sprung mass bar 12 is indisposed to go into vibration which would interfere with the high fidelity of the musical instrument. The frequency for each of the vibrating reeds is determined by grinding a neck around the vibrating reed at a small distance above the top of the cross-bar mass 12. Each neck is ground individually until the reed has the proper frequency for the note in question. The necks for the reeds 16, 17 and 18 are identified respectively by the reference characters 22, 23 and 24. The vibrating reeds are constructed of magnetic material and their upper or free vibrating ends are so magnetized that alternate free ends of the vibrating reeds have opposite magnetic polarities. As illustrated in the drawing, the reed 16 has a north pole at its upper end, the reed 17 a south pole, and the reed 18 a north pole. This alternate pole polarity would be carried out for a full series of the vibrating reeds for the complete keyboard of the piano. Mounted above the free vibrating ends of each of the vibrating reeds are the generating devices 30, 31 and 32 which may be mounted upon a top support member 35 by means of screws 36, 37 and 38, respectively. Each of the current generating devices comprises an inductance element which may comprise a magnetic core 34 and a coil 33 wound thereabout. The construction of the current generating devices is identical. The ends of the top support member 35 are carried by rubber blocks 45 which are mounted on the top of vertical column members 39 which have their lower ends provided with flanges 41 and anchored to the support member 11 by means of screws 42 passing through the flanges 41. The upper ends of the upright column 39 are provided with flanges 43 whereby the rubber blocks 45 may be anchored thereto by means of screws 44 passing through the flanges 43. The top support member 35 may be anchored to the rubber blocks 45 by means of the screws 46. The mounting of the top support member 35 upon rubber blocks keeps the top support member 35 from setting up vibrations which might interfere with the musical operation of the piano. The current generating device 30 is connected to the primary 51 of the transformer 50 by means of a conductor 47 and a contactor 59 which is actuated by the keys of the piano for the reed

16. Similarly, the current generating device 31 is connected to the primary 51 of the transformer 50 through a conductor 48 and a contactor 60, and the current generating device 32 is connected to the transformer 51 of the transformer 50 through a conductor 49 and the contactor 61. The lower end of the secondary winding of the transformer is connected to ground and the top ends of the coils 33 are respectively connected to ground through a conductor 53, which means that a closed circuit through the primary of the transformer is provided when each of the contactors 59, 60 and 61 is closed by the depressing of the keys associated therewith. Accordingly, a closed circuit for each of the current generating devices is provided when the contactor associated therewith is closed and the frequency of the current generated in each of the closed circuits is in accordance with the mechanical frequency of the vibrating reed associated with the current generating device. The top of each of the vibrating reeds has a removed edge portion 64 which is on the side of the reed opposite from the hammer 65. The removed edge portion 64 establishes a straight-line face for the vibrating end of the vibrating reed. When the vibrating reed is struck by the hammer 65 its upper free end vibrates with references to the core 34 of the current generating device associated therewith for generating a current in the coil having a frequency equal to the frequency of the vibrating reed. The sum of the respective currents from the current generating devices pass through the primary of the transformer 51 and generate a voltage in the secondary winding 52 of the transformer for operating the dynamic speaker 53 for producing the musical note. The volume of the piano may be governed by a volume control unit designated by the block 56 and may comprise any suitable well-known equipment. The amplifying circuit 57 may be of any well-known circuit which supplies amplified energy to the dynamic speaker 58.

The sprung mass bar 12, the vibrating reeds, the magnetic cores 34 of the current generating devices and the top support member 35, are constructed of flux conducting material so that a closed magnetic circuit is provided between adjacent vibrating reeds, since alternate vibrating reeds are provided with opposite magnetic poles. The closed magnetic circuit renders my current generating devices highly efficient with only a small air gap existing in the magnetic circuit. The hammers and the base 10 are not shown in Figure 1 for purposes of clarity.

In Figure 3 I show an electrical impulse means of vibrating the reeds and this may be done by modifying the construction of the contactors mounted under each of the keys, the modified contactor being shown diagrammatically in Figure 3 and comprises a bridging element 74 which contacts first the two contacts 75 and 76. The instant that the two contacts 75 and 76 are bridged by the bridge member 74 the condenser 78 which is charged dissipates its charge and excites the winding of the coil in the current generating device. The impulse of current passing through the coil attracts the vibrating reed associated therewith and sets the vibrating reed into vibration at its own natural frequency. As the key is further depressed the bridging member 74 contacts the contact point 77 and con-

nects the coil of the current generating device in circuit with the primary of the transformer for making the musical note. The moment that the key is released the bridge member 74 breaks contact with the contact members 75, 76 and 77 and then the condenser 78 is again recharged from a high voltage source indicated by the reference character 80. The resistor 79 determines the rate at which the condenser is charged. The condenser 78 becomes immediately charged the moment that the key is released with the result that rapid operation of the key is always secured.

Although I have described my invention in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim as my invention:

1. An instrument for producing sound comprising, a support member, a vibrating reed having two ends with one end thereof mounted to the support member, the free end of the said vibrating reed constituting a magnetic pole, a substantially closed flux conducting path including said vibrating reed, a current generating device associated with the magnetic pole and adapted to generate current having a frequency that corresponds to the frequency of vibration of the magnetic pole of the vibrating reed, means responsive to the current generated in the current generating device for producing sound, and means for vibrating the magnetic pole of the vibrating reed.

2. An instrument for producing sound, in combination, a support member constructed of flux conducting material, at least a first vibrating reed and a second vibrating reed carried by said support member, said vibrating reeds being spaced apart upon the support member and constructed of flux conducting material, said first vibrating reed having a north pole at its free vibrating end and said second vibrating reed having a south pole at its free vibrating end, a first current generating device associated with the north pole of the first vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the first vibrating reed, a second current generating device associated with the south pole of the second vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the second vibrating reed, said current generating devices each having a flux conducting core, second support means for supporting the flux conducting cores of the current generating devices in spaced relation respectively with the north and south poles of the vibrating reeds, said second support member being constructed of flux conducting material, an output circuit connected to the current generating devices for producing sound, and means for vibrating the magnetic poles of the vibrating reeds.

3. An instrument for producing sound, in combination, a support member constructed of flux conducting material, at least a first vibrating reed and a second vibrating reed carried by said support member, said vibrating reeds being spaced apart upon the support member and constructed of flux conducting material, said first vibrating

reed having a north pole at its free vibrating end and said second vibrating reed having a south pole at its free vibrating end, a first current generating device associated with the north pole of the first vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the first vibrating reed, a second current generating device associated with the south pole of the second vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the second vibrating reed, said current generating devices each having a flux conducting core, second support means for supporting the flux conducting cores of the current generating devices in spaced relation respectively with the north and south poles of the vibrating reeds, said second support member being constructed of flux conducting material, an output circuit connected to the current generating devices for producing sound, and mechanical impact means for vibrating the magnetic poles of the vibrating reeds.

4. An instrument for producing sound, in combination, a support member constructed of flux conducting material, at least a first vibrating reed and a second vibrating reed carried by said support member, said vibrating reeds being spaced apart upon the support member and constructed of flux conducting material, said first vibrating reed having a north pole at its free vibrating end and said second vibrating reed having a south pole at its free vibrating end, a first current generating device associated with the north pole of the first vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the first vibrating reed, a second current generating device associated with the south pole of the second vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the second vibrating reed, said current generating devices each having a flux conducting core, second support means for supporting the flux conducting cores of the current generating devices in spaced relation respectively with the north and south poles of the vibrating reeds, said second support member being constructed of flux conducting material, and an output circuit connected to the current generating devices for producing sound, electrical magnetic means for vibrating the magnetic poles of the vibrating reeds.

5. An instrument for producing sound comprising a support member, a vibrating reed mounted to the support member, said vibrating reed having a magnetic pole, a current generating device associated with the magnetic pole and adapted to generate current having a frequency that corresponds to the frequency of vibration of the magnetic pole of the vibrating reed, means responsive to the current generated in the current generating device for producing sound, and vibration producing means for vibrating the magnetic pole of the vibrating reed, said vibration producing means comprising a capacitor and contactor control means for first charging the capacitor and for secondly discharging the capacitor through the current generating device for attracting the magnetic pole and setting the reed into vibration.

6. In combination, a closed magnetic circuit, said magnetic circuit comprising at least two vibrating reeds of different vibrational frequencies, each vibrating reed having a vibratable free end with a magnetic pole of opposite polarity,

a current generating device comprising a coil surrounding a portion of the magnetic circuit, means for vibrating the vibrating elements, and an output circuit connected to the current generating device.

7. An instrument for producing sound, in combination, a base, a support member, rubber-like means for supporting the support member upon the base, a plurality of vibrating reeds each having a vibrating end and being carried by the support member, a substantially closed flux conducting path for each of said vibrating reeds, a plurality of current generating devices mounted relative to the vibrating end of the vibrating reeds, one current generating device for each vibrating reed, impact means for striking each of the vibrating reeds to set the reeds respectively into vibration, a mass carried by the support member to stabilize the support member upon the rubber-like means when the vibrating reeds are struck by the impact means, an output electrical circuit for producing sound, and a plurality of keys each having an electrical contactor, one for each current generating device for connecting the current generating devices respectively with the output electrical circuit.

8. An instrument for producing sound, in combination, a base, a first support member, first rubber-like means for supporting the first support member on the base, a vibrating reed carried by the first support member and having a free vibrating end, a substantially closed flux conducting path including said vibrating reed, a current generating device associated with the vibrating end of the vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the vibrating end of the vibrating reed, a second support member for supporting the current generating device, means including second rubber-like means for supporting the second supporting member upon the base, and an output circuit for producing sound connected to the current generating device.

9. An instrument for producing sound comprising, a support member, first and second vibrating reeds carried by said support member, said vibrating reeds including flux conducting material, said first vibrating reed having a vibrating portion of a given polarity and said second vibrating reed having a vibrating portion of opposite polarity, a substantially closed flux conducting path including said first and second vibrating reeds, means for vibrating the said vibrating reeds and electroacoustical means for producing sounds in accordance with the vibrations of said vibrating reeds.

10. An instrument for producing sound comprising, a support member, first and second vibrating reeds carried by said support member,

said vibrating reeds being constructed of flux conducting material, said first vibrating reed having a vibrating portion of a given polarity and said second vibrating reed having a vibrating portion of opposite polarity, a first current generating device associated with the first vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the vibrating portion of the first vibrating reed, a second current generating device associated with the second vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the vibrating portion of the second vibrating reed, a substantially closed flux conducting path including said first and second vibrating reeds, an output circuit connected to the current generating devices for producing sound, and means for vibrating the said vibrating reeds.

11. An instrument for producing sound comprising, a support member, first and second vibrating reeds carried by said support member, said vibrating reeds being spaced apart upon the support member and constructed of flux conducting material, said first vibrating reed having a north pole at its free vibrating end and said second vibrating reed having a south pole at its free vibrating end, a first current generating device associated with the north pole of the first vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the first vibrating reed, a second current generating device associated with the south pole of the second vibrating reed and adapted to generate a current having a frequency corresponding to the frequency of the second vibrating reed, second support means for supporting the current generating devices in spaced relationship, respectively, with the said north and south poles of the vibrating reeds, a substantially closed flux conducting path including said first and second vibrating reeds, an output circuit connected to the current generating devices for producing sound, and means for vibrating the said magnetic poles of the vibrating reeds.

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