July 28, 1936. V. H. SEVERY 2,049,084

HARMONIC CONTROL MEANS

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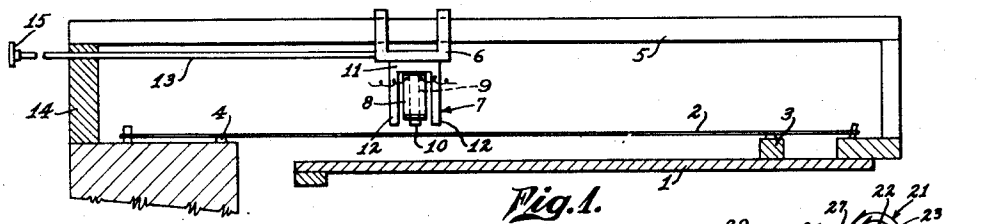


Fig. 1.

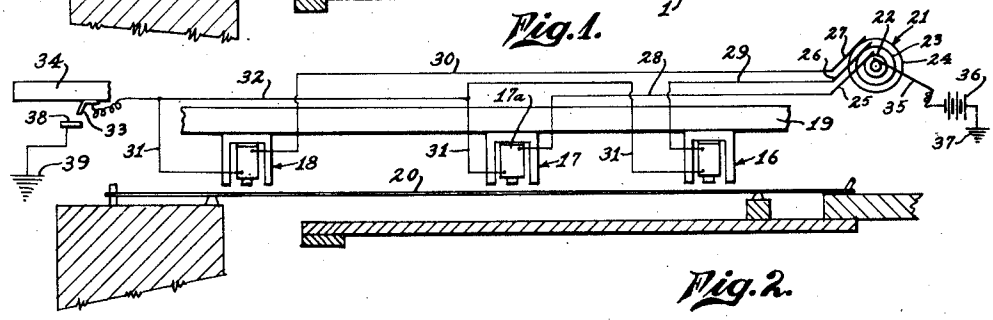


Fig. 2.

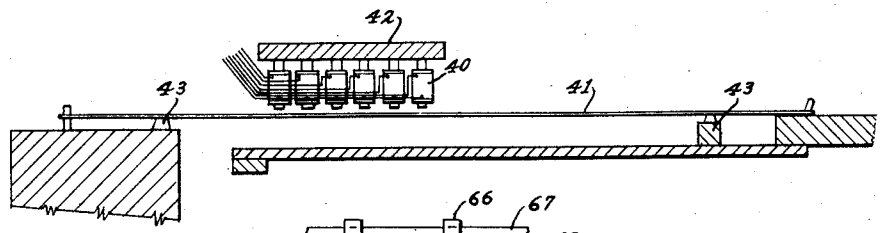


Fig. 3.

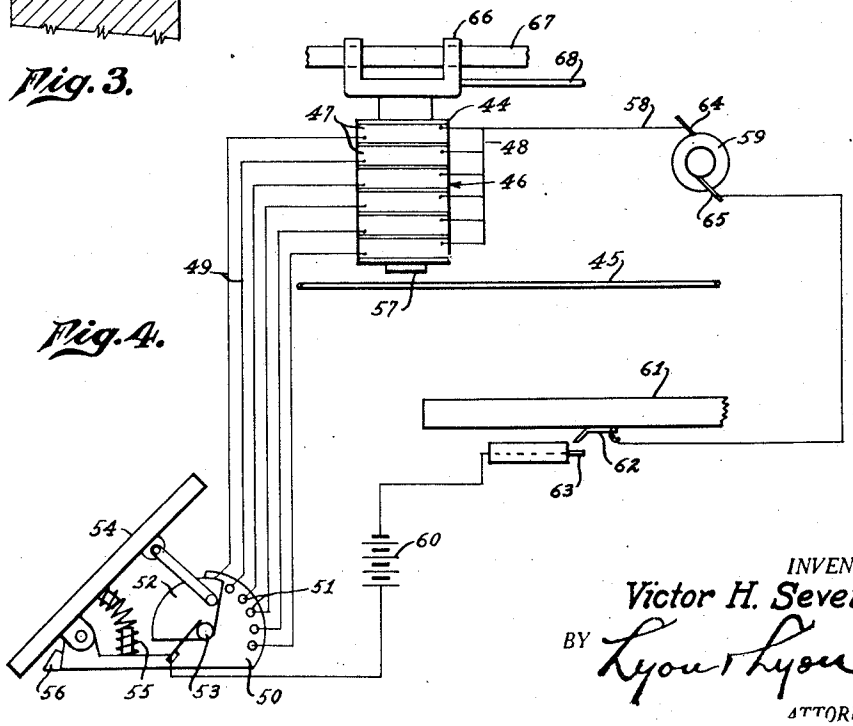


Fig. 4.

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HARMONIC CONTROL MEANS

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3 Claims. (Cl. 84—259)

This invention relates to musical instruments, and particularly to harmonic control means. The invention is particularly applicable to stringed instruments, such as the piano.

The general object of the invention is to provide simple means for vibrating the musical strings through the agency of electrical means, when the keys of the keyboard are depressed, and particularly to provide means for controlling the production of harmonics by the vibrating strings.

A further object of the invention is to provide simple means for developing harmonic vibrations in the strings, and for varying the character of the harmonics that are developed.

A further object of the invention is to provide simple electrical means controlled by the keys for vibrating the strings, for controlling the harmonics developed by their vibration, and for controlling the amplitude of vibration of the strings.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient harmonic control means.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Figure 1 is a diagrammatic view, which is a vertical section through an instrument embodying my invention, certain parts being broken away.

Figure 2 is a view similar to Figure 1, but illustrating the use of a plurality of electromagnets for vibrating the string, and illustrating the circuit for controlling the magnets.

Figure 3 is a view similar to Figs. 1 and 2, but illustrating another embodiment of the invention in which a series of magnets are employed for vibrating the string.

Figure 4 is a diagrammatic view illustrating an embodiment of the invention, in which a compound electric coil is employed with means for controlling the flow of current through the different elements of the coil, to vary the intensity of the attraction of the magnet for the string. In this view, certain parts are broken away.

Referring more particularly to the parts, and especially to Figure 1, 1 indicates the sounding board of the instrument across which the strings of the instrument are stretched. In the drawing, 2 indicates a string of the instrument which is mounted to vibrate between the bridges 3 and 4 across which the string is stretched. In the embodiment of the invention illustrated in Figure 1, I provide guiding means such as a guide bar 5 that extends parallel with the string, and on this guide bar I mount a carriage 6 carrying an electromagnet 7, said magnet including an electric coil 8. This magnet has an armature indicated by the dotted lines 9, the end of which projects as a pole 10, and lies adjacent the string 2. This electromagnet can be mounted in this way to cooperate with vertical strings or horizontal strings. If desired, the electromagnet may include a heavy metal pole piece 11 from which the armature 10 extends, being located between two outside pole pieces 12 which become magnetized when the current flows through the coil. The poles 12 also lie adjacent to the string and increase the magnetic attraction of the magnet for the string. Suitable means is provided for varying the location of the electromagnet along the length of the string, thereby enabling different harmonic tones to be developed when the string is vibrated by the electric current. For this purpose, I may provide a stem 13 that extends through a frame post 14 at one side of the instrument, said stem being provided with a head 15 to enable the same to be moved in or out to set the electromagnet at any desired point on the string.

If the electromagnet is located adjacent to the bridge 3, for example, at about an inch from the same, a tone rich in harmonics will be produced by the string when electric impulses are passed through the electromagnet at predetermined frequency. This frequency should correspond to the theoretical natural period of the desired harmonic of the string. The magnet is preferably located at a distance from the bridge, which is an aliquot part of the entire distance between the two bridges 3 and 4. Any suitable means may be employed for developing electric impulses of the necessary frequency.

In the embodiment of the invention illustrated in Figure 2, I employ a plurality of electromagnets 16, 17 and 18, which, if desired, may be adjustably mounted on a rail 19 corresponding to the guide rail 5. These magnets may be set at any desired point along the rail, to enable them to cooperate with the string 20 to produce fundamental and harmonic tones. The intermediate or central magnet 17 would produce the fundamental note, while the other magnets would produce harmonic notes. I connect the electromagnets up in an electric circuit, and provide means for passing impulses of a predetermined frequency through the different coils of these magnets. For this purpose, I provide rotary power driven means preferably in the form of a circuit interrupter indicated conventionally by the numeral 21, and comprising three rings 22, 23 and 24, each of these rings being composed of alternating contacts and insulation, and cooperating respectively, with brushes 25, 26 and 27. A brush

25 is connected by a circuit wire 28 with the coil 17a of the electromagnet 17. The other two brushes are connected by similar circuit wires 29 and 30, with the coils of the other electromagnets. The other ends of the coils may be connected by suitable conductors 31, to a common conductor or trunk 32 that leads to a contact 33 on the key 34 that corresponds to this string. The current flows into the circuit interrupter 21 through a brush 35 connected with the battery 36 or other source of E. M. F., one side of the battery being connected to the ground at 37.

A fixed contact 38 to cooperate with the contact 33 on the key, is connected to the ground at 39. The interrupter 21 is constructed so that when driven at a constant speed for which it is designed, electric impulses will be produced in the branches 28, 29 and 30 at a frequency corresponding to the period of the partial or harmonic that these particular electromagnets are intended to develop. The other magnet 17 will receive impulses at less frequency, and corresponding to the fundamental note of the string.

It will be evident that when the key 34 is depressed, an electric circuit will be established from the ground 37 to the ground 39, and giving electric impulses with predetermined frequency through the different electromagnets, thereby causing the vibration of the string, and causing it to vibrate in such a way as to develop the desired harmonic tones or partials. In this way, by placing magnets at different points on the strings, the timbre or color of different musical instruments can be reproduced.

In the embodiment of the invention illustrated in Figure 3, I provide a series of electromagnets 40 disposed in a row over the musical string 41. These magnets are attached to a board or carriage 42, and may be fixed at any point desired on the length of the string. These magnets are preferably disposed equidistant from each other, and as the length of the row is considerable as compared with the entire length of the string between the bridges 43, harmonic tones will be produced in the string. Furthermore, by employing a series of magnets in this way, the magnetic attraction for the string can be greatly multiplied, thereby increasing the volume.

In the embodiment of the invention illustrated in Figure 4, I provide means for controlling the intensity of the magnetic attraction of a single magnet 44 cooperating with a string 45. This magnet is preferably provided with a compound coil 46 composed of a plurality of elemental coils 47, said elemental coils being connected in parallel from a common lead 48, the other ends of the coils being connected with corresponding conductors 49 that lead to a cut-out switch 50 having contacts 51 corresponding respectively, to the different elemental coils.

The cut-out switch may include a segment 52 mounted for rotation at the point 53, so that it can be moved down more or less along the contacts 51. For operating this segment, a pedal 54 may be provided, which is normally held by a spring 55 against a stop 56. In Figure 4 the segment 52 is illustrated in engagement with the first contact 51 that would pass the current through the uppermost elemental coil 47. This will have the slightest effect in energizing the core of the compound coil, and will develop the smallest amount of magnetic attraction at the pole 57 of the magnet. As the pedal is depressed, the segment 52 will engage successively with the different contacts 51, and thereby increase the flow of current around the core of the magnet, which will increase the magnetization of its core, and increase the attraction for vibrating the string.

The electric circuit 58 includes an interrupter 59, a battery 60 and a key 61 controlling engagement of a movable contact 62 with a fixed contact 63. The interrupter 59 cooperates with an outlet brush 64, which runs on alternating contacts and insulation on the interrupter. The interrupter, of course, will be rotated at a proper uniform speed to develop impulses of the desired frequency in the compound coil 46. The current passes into the interrupters through a suitable brush 65.

If desired, this electromagnet 46 may be mounted on a carriage 66 running on a guide bar 67, and capable of being set at any point on the string, by means of a stem 68.

It is understood that the embodiment of the invention described herein, is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

It is most advantageous to apply the vibrating force to a string on its upper side, because the pull of the magnet is opposed to the action of gravity on the string, and this tends to equalize the amplitude of vibration across the axis of the string.

What I claim is:

1. In a musical instrument, the combination of a string mounted to vibrate and produce a musical note, a bridge engaging the string at a point along its length, an electromagnet located adjacent the bridge and having a pole located adjacent the string and at a point to vibrate the string to produce a partial tone corresponding to the position of the magnet with respect to the bridge, an electric circuit connected with the electromagnet, and rotary means for producing electric impulses in the electric circuit having a frequency corresponding to the period of vibration of a partial of the note produced by the string.

2. In a musical instrument, the combination of a string mounted to vibrate and produce a musical note, a plurality of electromagnets located at different points along the length of the string, each of said magnets having an electric coil, an electric circuit having branches passing through the said coils, means independent of the string, connected with each branch for developing electric impulses of a predetermined frequency, and a key corresponding to the string for closing the circuit through the said coils.

3. In a musical instrument, the combination of a string mounted to vibrate and produce a musical note, a series of electromagnets disposed in a row adjacent the string, and located at points with reference to the end of the string that will vibrate the string to produce partial tones from the string, and means for passing electric impulses through the coils of the said electromagnets at a predetermined frequency to vibrate the string.

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