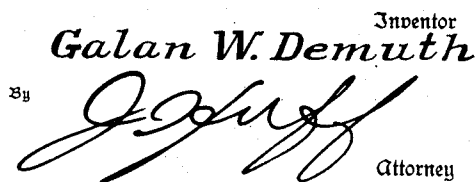


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ELECTRICAL MUSICAL INSTRUMENT FOR PRODUCING BELL TONES

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ELECTRICAL MUSICAL INSTRUMENT FOR
PRODUCING BELL TONESGalan W. Demuth, Moorestown, N. J., assignor to
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10 Claims. (Cl. 84-404)

This invention relates to electrical musical instruments for producing a bell-like tone, or what is more commonly designated as an electrical carillon. The device may be used to produce a single bell tone or a multiplicity of units of different pitch may be used to produce groups of bell tones or entire chromatic scales covering a very wide range. This application is in part a continuation of my application Serial No. 248,542, filed December 30, 1938.

It has heretofore been customary to use for the production of bell tones either actual bells or simulated bells or chimes. The simulated bells or chimes have usually been either an elongated hollow tubular member or a vibratable reed coiled into a circle or a spiral, the first form being customary in orchestral chimes, and the like, and the latter being more customary in clock chimes and similar devices. The coiled reed device has also been used in apparatus of the electrical type where a magnetic or electro-static pickup is located adjacent the vibratable member and served to pick up the vibrations which are amplified by an electronic amplifier and thereafter reproduced by one or more loudspeakers.

Such prior art devices have been subject to a number of difficulties in that they are extremely difficult to tune, have a large number of dissonant overtones interfering with the use of the several tones in chords and also interfering with recognizing the accuracy of tuning of the elements, and are difficult to design for the reason that the exact dimensions and characteristics of their vibrating elements is difficult to predict.

In the apparatus of the present invention, the vibrating element consists of a rod or wire preferably circular in cross-section, substantially straight and having a length which is great in relation to the diameter of the member. This rod is made of appropriate material, such as piano wire or tool steel, and is provided with an appropriate suspension, striking mechanism and magnetic pickup.

One object of the invention is to provide an improved striking mechanism for bar type vibrating members for producing bell tones.

Another object of the invention is to provide an improved striking mechanism for devices for producing bell tones.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawings in which

Figure 1 is a side view of a vibrating element

together with its attendant support, striking mechanism and magnetic pickup,

Figure 2 is a top view of the apparatus shown in Fig. 1,

Figure 3 is a view corresponding to Fig. 1 of a modified form of the striking mechanism and supporting mechanism,

Figure 4 is an enlarged view of the key spring of Fig. 3,

Figure 5 is a side view partly in section of the hammer and backing bar of Fig. 3,

Figure 6 is a front view of the hammer shown in Fig. 5,

Figure 7 is a side view of a modified form of hammer and backing bar,

Figure 8 is a front view of the form of hammer shown in Fig. 7,

Figure 9 is a side view of another form of hammer and backing bar, and

Figure 10 is a front view of the form of the invention shown in Fig. 9.

Referring first to Fig. 1, the vibrating member 10, which may be of such length as to be tuned to practically any desired pitch within the ordinary range of musical instruments, may be made of piano wire preferably having a diameter of .045" which is the most satisfactory value so far reached for tones in the middle range, i. e. for approximately two octaves above and below middle C although this size of the same material may be used considerably beyond this range and the invention is by no means limited to the use of either this material or material of this state of diameter.

The vibratable member per se is further described and claimed in my application Serial No. 248,542, above referred to, and an improved form thereof is described and claimed in my application Serial No. 338,088, filed May 31, 1940.

The vibrating member 10 may be secured by swaging, soldering, welding or in other similar manner into the block 11. Soldering is preferred as it is rapid and simple and provides a sufficiently rigid attachment of the vibrating member to the block. If the vibrating member is not rigidly attached to the block it will not vibrate properly due to damping in the attachment and the failure to provide sufficient reactance against the elasticity of the vibrating member. The block 11 may be attached to the heavier block 13 by means of a screw 12. This heavier block 13 is secured by the screws 14 to a metal plate 15. The screws 14 pass through slots 16 in which they are vertically adjustable. These slots 16 are into a plate 15 which may be

of brass, and which, in turn, is supported on spring members 19 which may be of steel or of phosphor bronze through which the member 15 is secured by bolts 20. It will be apparent that in this arrangement the vibrating member or members 10 react against the mass of the blocks 11 and 13 and the plate 15. If either the block 11, the block 13 or the plate 15 were supported directly upon the wood frame of the instrument, considerable damping would result from the action of the frame material while the spring mounting just described prevents any such damping.

The framework or cabinet of the instrument is indicated at 17 and on this is supported a key bed 18 which may be of wood, plastic composition, or the like, and to this key bed 18 the springs 19 are secured by appropriate screws. The block 13 is provided with a hole in which a tube 21, which may be of brass, German silver, or similar material, is slidable and which may be secured in fixed position in the hole by set screw 22. The tube 21 carries adjacent its lower end a rod 23 of suitably permanently magnetizable material 23, such as hard steel or one of the alloys now on the market, such as Alnico, etc. A soft iron member 24 is attached to the end of the magnet 23 either by staking, riveting, or the like, and this member 24, which is preferably flat so as to have a small dimension lengthwise of the vibrating member 10, carries the pickup coil 25 from which connections are run to an appropriate electronic amplifier.

The striking mechanism includes a key, such as that indicated at 26, which is pivoted at 27, and which is urged toward its upper position by an appropriate spring 30. In the upper position this key may rest against a felt pad 31 carried by a wooden bridge 32 supported on the member 18. When the key is suddenly depressed, it strikes the felt pad 33 which is carried on the member 18.

In the form of the striking mechanism shown in Figs. 1 and 2, the upper surface of the key carries a plate 29 to which the spring 30 is attached and this plate extends past the end of the key to carry the striking mechanism. The plate 29 carries a spring wire 34 which carries on its lower end the hammer 35-36. This wire 34 is preferably a piece of piano wire approximately .022" in diameter, and is soldered into the plate 29. It will be apparent, however, that a piece of any other desired type of spring material may be substituted for this wire. The member 35 is preferably a small brass cup of such weight as to give proper momentum to the hammer when the key is struck and in this cup is fitted the striking member 36, which is preferably of hardwood, for most of the notes. This member 36 is provided, as shown in the drawings, with a chisel-like edge for striking the member 10 at the desired point. On some notes, particularly the higher notes, it may be desired to strike the vibrating member 10 at a more precisely defined point and in this case a wire face may be placed across the front of the member 36.

To the rear of the member 34 a second wire member 37 is similarly soldered into the plate 29 and carries on its lower end a block 38 to which is attached a felt damper 39. This wire 37 is considerably more rigid than the wire 34 and may consist, for example, of a piece of piano wire .062" in diameter. When the key 26 is struck the wire 37 together with the block 38 and pad 39 urge the wire 34 forwardly toward the vibrating member 10, but when the key 26 strikes the pad

33 the block 38 is arrested and the hammer 35-36 swings forward by its own momentum, striking the vibrating member 10 a single sharp blow and then being retracted by the spring 34 into contact with the pad 39. When the spring wire 34 strikes the pad 39 its motion is damped and further vibration, such as a second striking of the wire 10, is prevented.

The exact point at which the wire is struck to produce the best tone quality is determined by loosening the screw 14 and moving the block 13 up or down in relation to the plate 15. This point cannot be accurately predetermined as slight variations in the texture or hardness of the material of the vibrating element 10 may produce great variations in the overtones produced and I have accordingly found it most desirable to adjust the striking point after the apparatus is assembled and the vibrating element is tuned. The position of the pickup element 24 is likewise adjustable by loosening the set screw 22 and sliding the tube 21 up or down in the block until it is located at such a point on the vibrating element that the most desirable tone or combination of tones is produced.

In the form of the invention shown in Figs. 3 to 10, a slightly different type of key is substituted for that shown in Fig. 1. In these forms of the device the key 40 is supported on the metal member 41. This member 41 has formed integral with it two upstanding ears 42 through which the shaft 47 passes. The shaft 47 may be of such length as will support as many keys as are necessary and it may be supported at its ends and also at appropriate intervals by brackets 48 secured to the key bed 18. In these forms of the invention the key spring is also modified in form. Each key is provided with a spring 43 shown enlarged in Fig. 4 secured by the screw 44 to the collar 45. The collar 45 fits on the shaft 47 and is secured thereto by the set screw 46. The pressure of the spring on the key 40 may be adjusted as desired by rotation of the collar 45 on the shaft 47 and securing it in adjusted position.

The metal plate 41 is extended beyond the vertical plane passing through the shaft 47 and this extension is provided with a slot 49 in which the hammer portions of the device are adjustably secured by an appropriate screw 51 entering the angle bracket or equivalent portion of the hammer member 50.

In Fig. 3 there is shown an alternative form of support for the vibrating reed. In this form of support metal brackets 65 are secured to the key bed 18 and carry the rubber grommets 66 through which pass the screws 67 securing the angle brackets 68 to the rubber members 66. The angle brackets 68 carry metal washers 71 against which the plate 69 is secured by the screws 70. The plate 69 may support the reed blocks 13 with their attendant parts in the same manner as they are supported by the plate 15 in Fig. 1.

In the form of hammer mechanism shown in Figs. 3, 5, and 6 a bar 52 which may be of wood or equivalent rigid materials is secured to the key extension 41 by an appropriate angle bracket 50. This bar 52 carries on its front a thin spring 53 secured by an appropriate screw 59 so that it may swing forwardly away from the bar 52. The lower end of the spring 53 carries the wedge-shaped striking member or hammer 54 which is secured to it by the screw 55. When this hammer is in its rearmost position with the spring against the bar 52, the hammer lies against the felt or soft leather insert 58. At the rear of the hammer there is provided a narrow wire extension 56

which passes through the narrow slot 57 in the bar 52. This extension will serve two purposes; first, it maintains the hammer accurately in alignment with the middle of the bar 52, and, secondly, by the bent end thereon it may serve to prevent the hammer 54 from moving too far from the bar 52.

The rearmost position of the hammer is determined by the screw 61 which is threaded into the bracket 62 and locked by the nut 63 and against which abuts the felt bumper 60 secured to the bar 52. This bumper, of course, may be made of leather or some other non-resilient material. Inasmuch as the member 52 is a rigid bar substituted for the heavy spring 37 of Fig. 1 and each of these members serves as a back support as well as a back stop for the hammer, they will be hereinafter referred to as backing bars.

It will be apparent that the operation of the form of the invention shown in Figs. 3 to 6 is very similar to that shown in Fig. 1 in that the hammer is depressed against the spring action until it strikes the bottoming felt 33 and the hammer then moves forward by its own momentum against the action of its supporting spring until it strikes the vibratable reed 10. The hammer rebounds from the reed and is withdrawn by a supporting spring until it strikes the non-resilient bumper on the backing bar which prevents the hammer from bouncing and again striking the spring.

In the form of hammer and backing bar shown in Figs. 7 and 8 the backing bar 80 is made of metal, such, for example, as brass, and has one end turned over to support the damping pad 81 while the other end is turned over to receive the screw 51 and secure the bar to the key. A middle portion 85 is also turned over to receive the back stop damper 60. The hammer 54, in this case, is supported on a metal strip 82 which may be made of any light metal, such as aluminum alloy, for example, such that the action of the hammer will be mainly under control of the momentum of the hammer rather than that of the supporting bar. This strip 82 is secured to a spring 83 in an appropriate manner, such, for example, as by the eyelets 84 and the spring 83 is similarly attached to the bent down member at the top of the backing bar 80. The spring 83 is preferably formed from a rectangular piece of material having a more or less rectangular hole punched out of the middle thereof so that the spring will be very flexible in the direction of momentum of the hammer but will be relatively rigid in the direction perpendicular thereto thereby maintaining the hammer accurately in alignment with the vibratable element.

In the form of the invention shown in Figs. 9 and 10 the backing bar 90 is made of metal as in Figs. 7 and 8 and carries a similar bracket 91 supporting the felt 60 but the turned-over portion 95 which supports the damper 81 is at the back instead of at the front of the bar. In this form of the invention the hammer 54 is supported on a relatively rigid bar 92 which is preferably made of a light material such as aluminum or aluminum alloy but this bar 92 is pivoted to the backing bar 90 instead of being spring-mounted thereto. This pivoting is accomplished by an appropriate screw 93 secured by a nut 94 and the hammer bar 92 is appropriately spaced by means of the washers 99. It will be obvious, of course, that a rivet or any other equivalent pivoting means may be substituted for the screw 93. A small extension hook 96 is secured into the rear of the hammer bar 92 and another similar hook is con-

nected thereabove to the backing bar 90. These two members support the small coil spring 98 which serves to maintain the hammer 54 in the retracted position and against which the hammer may move forward under its own momentum.

I claim as my invention:

1. Striking mechanism for a vibratable element of the class described, comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a second relatively rigid spring means connected to said key and supporting damping means in contact with said first spring supporting means adjacent to said hammer.

2. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a relatively rigid means connected to said key and supporting damping means in contact with said spring supporting means adjacent to said hammer.

3. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a relatively rigid means connected to said key supporting damping means in contact with said spring supporting means adjacent to said hammer, and a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element.

4. Striking mechanism for a vibratable element of the class described, comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a relatively rigid means connected to said key supporting damping means in contact with said first spring supporting means adjacent to said hammer and a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element.

5. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a second relatively rigid spring means connected to said key, supporting damping means in contact with said first spring supporting means adjacent to said hammer and a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element.

6. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a second relatively rigid spring means connected to said key and supporting damping means in contact with said first spring supporting means adjacent to said hammer.

7. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a second relatively rigid spring means connected to said key and supporting damping means in contact with said first spring supporting means adjacent to said hammer, and a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element.

8. Striking mechanism for a vibratable element of the class described, comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, a relatively rigid means connected to said key sup-

porting damping means in contact with said first spring supporting means adjacent to said hammer, a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element, and a second stop limiting retractile movement of said rigid means.

9. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, relatively rigid means connected to said key and supporting damping means in contact with said first spring supporting means adjacent to said hammer, and spring means for raising said key and retracting said relatively rigid means.

10. Striking mechanism for a vibratable element comprising a movable key, a hammer having an appreciable mass, spring means supporting said hammer on said key, relatively rigid means connected to said key supporting damping means in contact with said spring supporting means adjacent to said hammer, a stop supported in cooperative relation to said key in position to stop the movement thereof before the hammer reaches the vibratable element, spring means for raising said key and retracting said relatively rigid means, and a stop limiting the retractile movement of said rigid means.

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