

July 25, 1939.

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2,167,600

APPARATUS FOR PRODUCING MUSICAL SOUNDS

Filed June 9, 1936

4 Sheets-Sheet 1

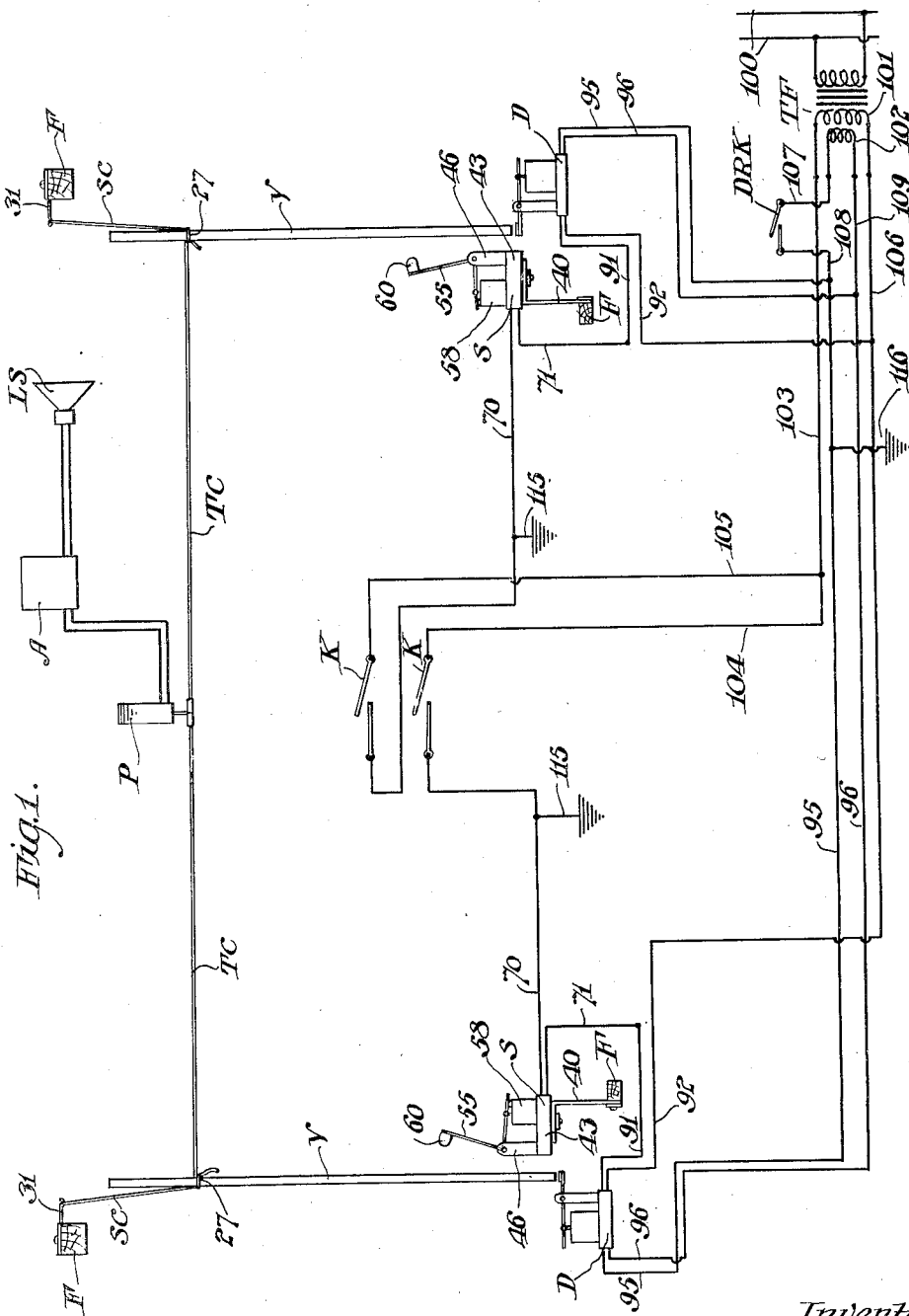


Fig. 1.

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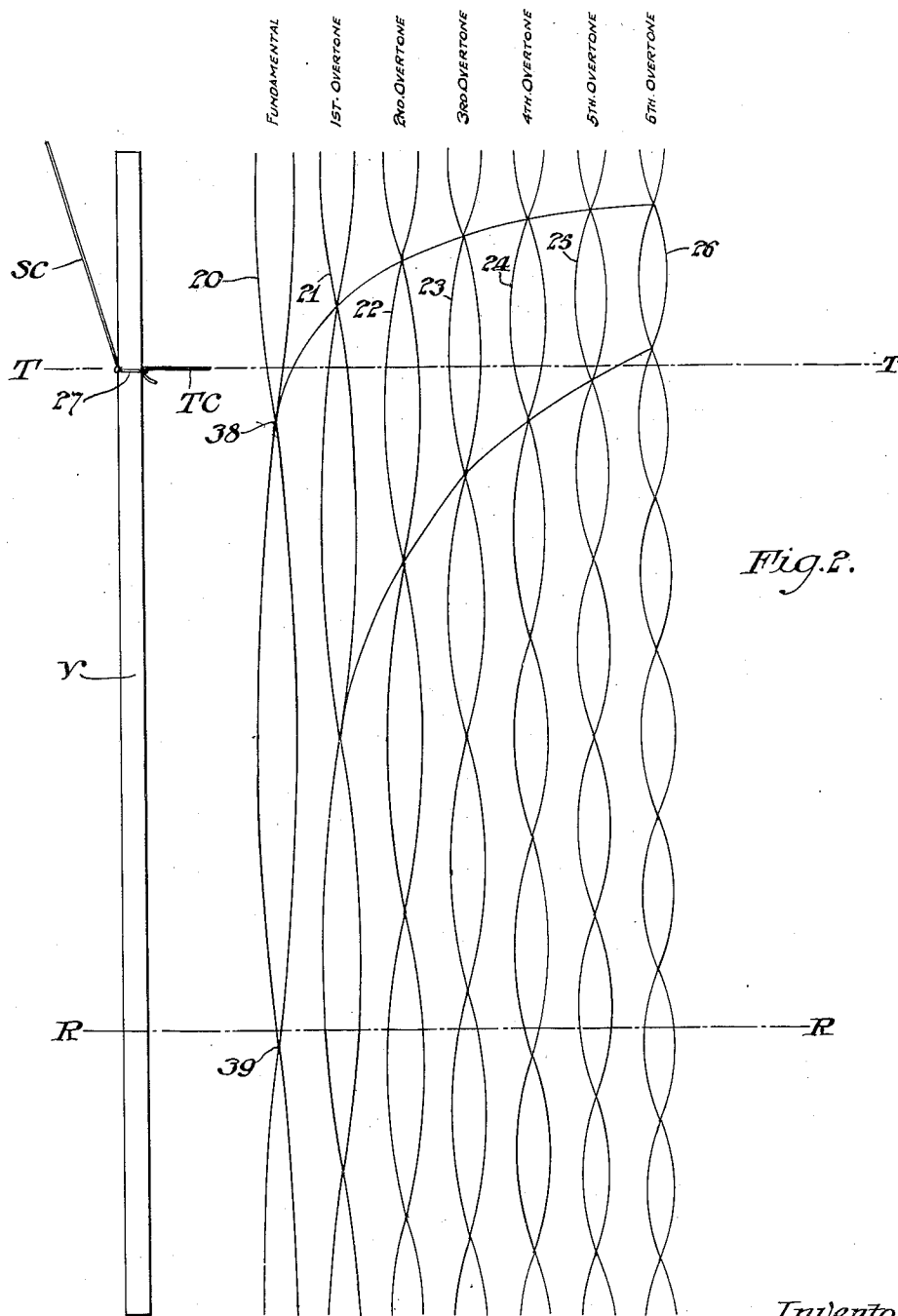
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APPARATUS FOR PRODUCING MUSICAL SOUNDS

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4 Sheets-Sheet 2



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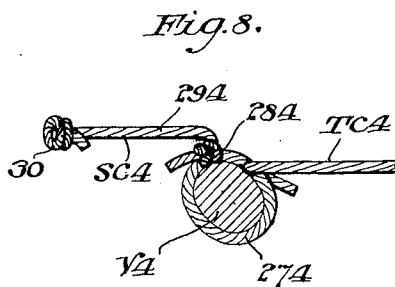
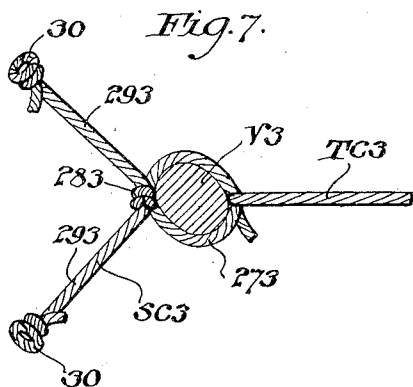
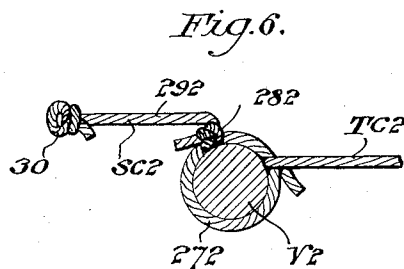
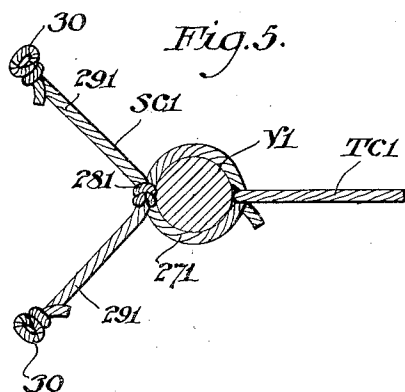
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APPARATUS FOR PRODUCING MUSICAL SOUNDS

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4 Sheets-Sheet 4



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APPARATUS FOR PRODUCING MUSICAL SOUNDS

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Application June 9, 1936, Serial No. 84,253

16 Claims. (Cl. 84—1.04)

My invention relates to methods of and apparatus for producing musical sounds and more particularly to the novel steps and apparatus involved in the production of amplified and audible sounds which will closely resemble the musical sounds of bells or chimes.

The beauty and popularity of the music of carillons, chimes and bells is well-known. However, the apparatus used for the production of such music requires considerable space and is itself very heavy and requires strong supporting structure and foundations which limit the size of the installation. In addition, the apparatus is expensive to build and operate and frequently requires an operator having a high order of skill to produce pleasing effects.

The present invention contemplates a unit having a number of vibratory elements which when set in vibration oscillate in accordance with predetermined and selected frequency components related to the fundamental but in which the effect of the fundamental is substantially eliminated in order to obtain the desired tone.

It is an object of the present invention to provide novel vibratory elements which may take the form of rods of metal or other suitable material of predetermined shape and which are mounted in accordance with the present invention.

It is an object of the present invention to provide methods of and apparatus for producing, in vibratory elements, the desired quality of tone and amplifying the tone produced in such a manner as to give the effect of bells or chimes.

It is a further object of the invention to provide a novel form of vibratory elements.

It is an object of the invention to provide vibratory elements and so mount the same that oscillations capable of selection and amplification will be produced.

It is an object of the present invention to provide methods of and apparatus for producing the effect of carillons or chimes in a simple and efficient manner and which will not require a high degree of skill of the performer.

It is also an object of the present invention to provide a musical instrument which includes, as elements thereof, vibratory devices from which the effect of the music of bells can be obtained.

It is a further object of the invention to provide a novel form of mounting for vibratory elements whereby the desired condition of oscillation can be obtained.

It is a further object of the invention to pro-

vide in combination with other features a novel form of vibration pick-up.

Other objects of the invention will appear from the specification and claims.

The nature and characteristic features of the invention will be more readily understood from the following description, taken in connection with the accompanying drawings forming part hereof, in which:

Figure 1 is a diagrammatic view showing a preferred form of a device constructed in accordance with the present invention, two sound producing units being illustrated;

Fig. 2 is a diagrammatic view showing the manner of location on a vibratory element of the vibration transmission cord and of the striking point;

Fig. 3 is a fragmentary elevational view illustrating the manner of attaching the suspension cord and the transmission cord to one of the vibratory elements;

Fig. 4 is a fragmentary plan view showing details of the mounting structure;

Fig. 5 is a fragmentary plan view with the vibratory element shown in section illustrating the manner of attachment of the suspension cord and the transmission cord for producing the effect of a stationary bell or chime without any tremolo;

Fig. 6 is a fragmentary plan view with the vibratory element shown in section illustrating the manner of attachment of the suspension cord and transmission cord for producing the effect of a swinging bell;

Fig. 7 is a fragmentary plan view, partly in section, illustrating the manner of attachment of the suspension and the transmission cords and the type of vibratory member employed for producing the effect of a stationary bell with a tremolo;

Fig. 8 is a fragmentary plan view, partly in section, illustrating the manner of attachment of the suspension cord and the transmission cord, and the type of vibratory member employed, for producing the effect of a swinging bell with a tremolo;

Fig. 9 is a fragmentary elevational view showing the pick-up apparatus and illustrating the manner of attachment of the transmission cords from a plurality of vibratory units;

Fig. 10 is a horizontal sectional view of a portion of the pick-up apparatus taken approximately on the line 10—10 of Fig. 9;

Fig. 11 is a side elevational view, partly in

section, of a striker and Fig. 12 is an end elevational view of the striker shown in Fig. 11;

Fig. 13 is a side elevational view, partly in section, of a damper for the vibratory element; and

Fig. 14 is a plan view of the damper illustrated in Fig. 13.

It will, of course, be understood that the description and drawings herein contained are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

Referring more particularly to Fig. 1 of the drawings, in which a preferred embodiment of the invention is illustrated diagrammatically, it will be seen that the unit includes as parts thereof, vibratory elements V, strikers or vibration producing devices S, dampers D, and pick-up apparatus P, constructed and arranged in certain predetermined or critical relationships which will be referred to in detail.

A plurality of units comprising vibratory elements, strikers, and dampers are employed in the complete device, although, for purposes of simplifying the disclosure, I have illustrated but two vibratory elements and the structure appurtenant thereto.

Each vibration producing unit includes a vibratory element V, which is supported by a suspension cord SC, adjustably secured with respect to a portion of the frame F of the instrument.

A striker S, one for each vibratory element V, is also mounted on the frame, and arranged in a predetermined adjustable position with respect to the vibratory element V, as hereinafter pointed out. A damper D, one for each vibratory element V, likewise carried by the frame, is mounted for contact with the end portion of the vibratory element V. A transmission cord TC is attached to each vibratory element V at the point of attachment of the suspension cord SC and extends from vibratory element V to a portion of the electrical pick-up apparatus P. The pick-up apparatus may be electrically connected to any suitable transmitting lines but is preferably connected to an amplifier A which in turn is connected to a loud speaker LS. The several portions of the apparatus will now be described in detail.

The vibratory elements V, forming part of the apparatus of the present invention comprise bars or rods of metal, wood, glass, or other vibrant material, suitably suspended. It has been ascertained that the cross sectional shape of the rod affects the character of vibration of the rod. The rod or bar for certain effects is preferably circular in cross section, as shown more particularly in Figs. 5 and 6 of the drawings at V1 and V2, respectively. It has also been ascertained that a distinctly different sound effect is obtained if the bar or rod is of very slightly elliptical cross section. A bar of this character is illustrated in Figs. 7 and 8, at V3 and V4 respectively, the flattening or deformation of the bar from that of circular cross section being exaggerated for purposes of illustration.

In Fig. 2 there is illustrated one of the vibratory elements V together with a chart showing the fundamental vibration as at 20, the first overtone as at 21, the second overtone as at 22, the third overtone as at 23, the fourth overtone as at 24, the fifth overtone as at 25, and the sixth overtone as at 26.

The vibratory elements may be supported in any manner desired, but it has been found ad-

vantageous to suspend the bars or rods so that they hang with their longitudinal axes vertical. Suspension cords of a material such as textile fiber, rawhide or the like, that will absorb a minimum of vibratory energy are used, and, as shown in Fig. 3, a piece of cord encircles the bar or rod V to form a loop 27 and is knotted as at 28 to hold the loop snugly against the bar or rod V. The ends 29 of the cord are hung as by the knots 30 on spaced supporting pins 31. These pins 31 have hooked or depressed end portions 32 for retaining the cords in position. Each pin 31 passes through a groove 33 in a portion of the frame F and a disc or washer 34, held in position by a wood screw 35, permits of adjustment of the pin 31 and the cord carried thereby as required. The remaining portion of the support for the bar V includes the transmission cord TC which is attached to the vibratory element by passing the same through the loop 27 at the place of attachment of the loop 27 to the vibratory element V and is held in position against the vibratory element V by reason of the tightness of the loop 27.

The transmission cord TC has a function in addition to that of supporting the vibratory element V. Vibrations set up, as hereinafter pointed out, in the vibratory element V may be transferred to other desired locations. The vibration existing at the point of attachment of the transmission cord TC may be transferred by the transmission cord to the transfer or pick-up unit P. The manner of attachment of the cord TC to the vibratory element V is of importance in its relation to the results obtained. The point of longitudinal attachment of the transmission cord TC is likewise important.

In Fig. 5 there is illustrated the arrangement of a vibratory element V and its support for obtaining a sound similar to that of a stationary bell or chime without any tremolo. The vibratory element for this effect is circular in cross section as shown at V1 and the suspension cord SC1 is looped, as at 271, around the vibratory element V1, knotted, as at 281, and has its ends 291 at substantially equal angles with respect to the knot 281. The transmission cord TC1 passes through the loop 271 diametrically opposite the knot 281.

In Fig. 6 there is illustrated the arrangement of the vibratory element and its support for obtaining a sound similar to that of a swinging bell. The vibratory element for this effect is circular in cross section, as shown at V2. The suspension cord SC2 is looped, as at 272, around the vibratory element V2, knotted, as at 282, and preferably has a single supporting portion 292 to permit a vertical rolling movement of the vibratory element V2. The knot 282 may be placed around on the side of the vibratory element V2, and, if two supporting portions are used, the ends of the cord may be of the same or different lengths. The transmission cord TC2 is arranged to pass through the loop 272 a relatively short distance around the circumference from the knot 282. The angle formed by radii of the vibratory element V2 extending to the knot 282 and the cord TC2 is considerably less than 180°.

In Fig. 7 there is illustrated the arrangement of the vibratory element and its support for obtaining a sound similar to a stationary bell with a tremolo. The vibratory element for this effect is very slightly elliptical in cross section, as shown at V3, although for purposes of illustration, the deformation from a circular cross section has been exaggerated. The suspension cord SC3 is looped, as at 273, around the vibratory element

V3, knotted, as at 283, and preferably has its ends 293 at substantially equal angles with respect to the knot 283. The transmission cord TC3 is passed through the loop 273, and the vibratory element V3, is turned so that the major or minor axis of the elliptical cross section is at an angle preferably of about 45°, to the transmission cord TC3.

In Fig. 8 there is illustrated the arrangement of the vibratory element and its support for obtaining a sound similar to a swinging bell with a tremolo. The vibratory element for this effect is slightly elliptical, as at V4, the same as illustrated in Fig. 7, but the vibratory element is supported in substantially the same manner as shown in Fig. 6. The suspension cord SC4 is looped around the vibratory element, as at 274, knotted, as at 284, and preferably has a single supporting portion 294 to permit a vertical rolling movement of the vibratory element. The transmission cord TC4 is passed through the loop 274 a relatively short distance around the circumference from the knot 284 and so that the transmission cord TC4 is at an angle, preferably of about 45°, to the major or minor axis of the elliptical cross section.

The tension of the transmission cord TC may be varied by lengthening or shortening the distance between the vibratory element V and the pick-up apparatus P. The snug fit of the transmission cord TC in the loop 27 permits of such an adjustment. The supporting and transmission cords may be secured in the proper position of adjustment by the application thereto of a suitable adhesive.

The material used for the transmission cord TC is varied in accordance with the pitch of the vibratory element. For low pitch or bass notes a soft, heavy, resilient cord is employed so that rattles caused by the increased length of vibration displacement are minimized and so that the higher overtones may be reduced and the bass notes may predominate. The transmission cord TC may be of textile fiber, rawhide or similar material.

For notes of higher pitch or in the upper register of the vibratory elements, the transmission cords TC must be harder, lighter and less resilient, so that these cords are capable of transmitting higher tones at a maximum efficiency and of accentuating the normal overtones of the higher pitched bar.

The vibrations available for transmission are likewise affected by the location of the suspension cord SC and the transmission cord TC along the longitudinal axis of the vibratory element V. While the tonal quality which it is desired to obtain requires the elimination insofar as possible of the effect of the fundamental vibration, at the same time certain of the overtones must be retained as a requisite to the production of the bell-like tone.

The location of the suspension cords SC and the transmission cords TC will be understood more readily upon reference to Fig. 2. It will be noted that if the transmission cord TC is attached at the node 38 of the fundamental vibration, there would not be any transmission of the fundamental frequency and practically none of the fourth overtone.

The loss of the fourth overtone would remove some of the richness of the tone and by reason of the fact that the fifth overtone would be strong and the sixth overtone at a maximum, the effect would be sharp and irritating.

In accordance with the present invention and for the purpose of obtaining the desired vibratory effect with the resulting tonal quality, the transmission cord TC is preferably located at, and attached to, the vibratory element V at approximately .183 times the length of the vibratory element V measured from the top of the element. This location is indicated by the line T—T in Fig. 2. Other points of attachment do not yield the same pleasing results.

The node 38 of the fundamental is located at approximately .232 times the length of the vibratory element V from the top thereof and the deviation from the node by the attachment of the transmission cord .183 times the length of the vibratory element V from the top eliminates most of the effect of the fundamental vibration. At this point of attachment for the transmission cord TC, i. e. at .183 times the length of the vibratory element from the top, the overtones from the sixth down to the first, have no nodes, as may be seen from the line T—T, and are capable of transmitting their vibrations to the transmission cord TC although their relative intensities are not in proper order. The adjustment to bring the intensities into their respective order is taken care of by the proper location of the striking point, as hereinafter pointed out.

The location of the striking point will be understood more readily upon reference to Fig. 2. In order that the respective intensities of the overtones be brought into their respective order, it has been found desirable to strike the vibratory element V above the lower fundamental node 39, which node 39 is located at approximately .232 times the length of vibratory element V from the lower end thereof. It has been ascertained that the point at which the striking should be effected is approximately .014 times the length of the vibratory element V above the lower fundamental node 39, which places the striking point at .246 times the length of the vibratory element V, measured from the lower end thereof. This position of the striking point is indicated by the line R—R, Fig. 2, which also shows the relationship of the striking point to the other overtones. Striking of the vibratory element V at this point gives a more pleasing effect than would be obtained by striking the vibratory element V at some other place.

While any preferred form of striker may be employed, it has been found desirable to use a striker of the type shown in Figs. 11 and 12. The striker S includes a striker mounting bracket 40 which is attached by a screw 41 and washer 42 to a portion of the frame F for vertical adjustment of the striker S. The striker mounting bracket 40 has a horizontally disposed base portion 43 adjustably mounted thereon by means of a screw 44 and washer 45. Arms 46 extend upwardly from the base portion 43 and at their upper ends have aligned holes 47 to provide a bearing.

A striker solenoid coil 48 is mounted on the base portion 43 and has a central aperture 49 for receiving a soft iron armature 50. The terminals of the solenoid are shown at 51 and 52. A striker link 53, of brass or other non-magnetic material, is secured to and extends from the striker armature 50 and has a loop 54 in the upper end thereof. A striker arm 55 is journaled, with respect to the arms 46, in the bearing holes 47, and the loop 54 is in engagement with the horizontal portion of the arm 55.

A soft cushion 56 for contact by the end portion of the striker arm 55 on its return movement

is provided on the upper end of the striker solenoid 48.

The striker solenoid 48 preferably has ends 51 of fibrous material and is encased in an aluminum covering 52 which is grounded, as at 53, and protects and shields the solenoid coil 48.

A striker head 60 is mounted on the upper end of the upwardly extending portion of the striker arm 55.

10 The striker S is adjustable vertically and horizontally by means of the screws 41 and 44 to a location such that the striker head 60 is in position to contact the vibratory element V at the striking point, on the line R—R.

15 Wires 70 and 71 are connected to the solenoid terminals 51 and 52, respectively, so that the same may be energized as hereinafter pointed out, from a suitable source of electrical energy by an operating key K, forming part of the keyboard of the instrument.

20 A damper mechanism is illustrated in Figs. 13 and 14 and includes a damper base member 72, which is secured to a portion of the frame F. The damper base member 72 has upwardly extending arms 73 provided with aligned bearing holes 74.

A solenoid member which includes a winding 76 and a winding 77 is mounted on the damper base member 72, and the solenoid member has a central aperture 78 for receiving a soft iron damper armature 79. A damper link 80 of brass or other non-magnetic material is secured to and extends from the damper armature 79 and has a terminal loop 81 at the upper end thereof.

35 A damper lever 82 is journaled in the bearing holes 74 of the arms 73, and the loop 81 of the damper link 80 is in engagement with one end portion of the damper lever 82. The other end portion of the damper lever 82 has mounted thereon a pad receiving base 84 of wood or similar material, upon which is carried a pad 85 of felt, rubber or other vibration damping material.

The windings 76 and 77 are encased in an aluminum covering 86 which is grounded as at 87.

45 The winding 77 has terminals 89 and 90 to which wires 91 and 92 are respectively connected. The winding 77 is intended to be energized so that by reason of its lesser inertia effect the damper pad 85 is released from contact with the vibratory element V a very short interval of time prior to the contact of the striker head 60.

The winding 76 has terminals 93 and 94 to which wires 95 and 96 are respectively connected.

55 The winding 76 is energized independently of the winding 77 and is connected in a suitable circuit so that all the dampers D may be released simultaneously by actuation of a damper release control key DRK.

60 An arrangement of circuits for controlling the striking and damping of the vibratory elements V will now be described although it will, of course, be understood that mechanically actuated structure could be employed for striking and damping.

65 Power lines are shown at 100 and to these a transformer TF is connected. The transformer TF has two secondary windings at 101 and 102, respectively, in order that the power input to the device will be in the same phase relationship.

70 The transformer winding 101 has a wire 103 connected thereto from which branches, as at 104 and 105, are connected respectively to the control keys F. The other side of each control key K is connected by the wire 70 to the terminal 51 of a striker solenoid coil 48. The other striker solenoid terminal 52 is connected by the wire 71

to the wire 91 which leads to the damper solenoid terminal 89. The damper solenoid terminal 90 is connected by wire 92 to the return wire 106 connected to the transformer winding 101.

It will be seen that this circuit provides for release of the damper D and for actuation of the striker S.

The transformer winding 102 is connected by a wire 107 to the damper release control key DRK. The key DRK has a wire 108 connected thereto from which branches 95 run to the terminals 93 of each of the damper solenoids 76. Wires 96 connect the terminals 94 of the damper solenoid windings 76 to the return wire 109 connected transformer winding 102.

This circuit provides for simultaneous release of all the dampers D in accordance with the actuation of the damper release control key DRK.

In order to reduce the static disturbances the respective circuits may be connected to ground as indicated respectively at 115 and 116, and if desired suitable condensers (not shown) may be employed, such as by connecting the same across the operating keys.

The pick-up apparatus P is suitably supported by the frame F of the instrument and includes a pick-up coupling member 110. The ends of the transmission cords TC remote from the vibratory elements V are secured thereto. The pick-up coupling member 110 preferably comprises a pair of rings secured together as at 111 and from the point of securing a pick-up actuator rod 112 extends for coaction with a pick-up transmitter 113 of any desired type.

The pick-up transmitter is connected to an amplifier unit A, if it is desired to amplify the sound vibrations at the place the instrument is mounted, and the amplifier unit may be connected to a loud speaker LS. It will be clear, of course, that the pick-up transmitter 113 may be connected to telephone lines or to radio transmitting apparatus if it is desired to transmit to distant points the vibrations produced by the vibratory elements V.

The operation of the apparatus as the same is used for producing musical sounds having the effect of bells will now be pointed out.

It will be understood, of course, that the apparatus is placed in proper adjustment with the suspension cords SC and transmission cords TC in their proper relationship to and spacing from the top of each of the vibratory elements V, and with each of the strikers S in its proper relation to the striking point of the respective vibratory elements V.

The appropriate key K of the keyboard is depressed by the operator. A circuit is set up from the source of electrical energy 101, through wire 103, wire 104 or 105, key K, wire 70, striker solenoid 48, wire 71, wire 91, damper solenoid 77, wire 92, wire 106, to the source 101. The completion of this circuit causes the actuation of the striker armature 50, and through the striker link 53 and striker arm 55, the striker head 60 is impacted once against the vibratory element V at the striking point and on rebounding is held out of contact with the vibratory element by the striker armature 50.

The impact of the striker head 60 causes the vibratory element V so struck to vibrate in accordance with its vibrant characteristics.

At the same time that the striker S is brought into operation, the circuit thus set up through the damper solenoid 77 releases the damper pad 85. The inertia of the damper arm and pad is

less than that of the striker head and arm and the damper pad 85 is released just prior to the stroke of the hammer. The release of the damper pad 85 is effected by the actuation of the damper armature 79 by the damper solenoid winding 77. The energization of the damper solenoid causes the armature 79 to move upwardly and the lever 82 is actuated so that the pad 85 is moved from contact with the vibratory element V. As soon as the circuit is broken by the release of the key K, the damper solenoid winding 77 is deenergized and the damper pad 85 again moves to its damping position by reason of the weight of the armature 79.

The dampers D for all the vibratory elements V may be released simultaneously by actuation of the damper release control key DRK. The two circuits for actuating the solenoids of the dampers D, as pointed out above, are connected to the same source of electrical energy so that the two windings 76 and 77 are additive and will not operate in opposition. This is accomplished by maintaining the same phase relationship in the two circuits, the transformer TF being employed as a common source of electrical energy for this purpose.

The circuit for the simultaneous release of all the dampers D may be traced as follows: from the source of electrical energy 102, through wire 107, damper release key DRK, wire 108, wire 95, solenoid winding 76, wire 96, wire 109, to the source 102.

When a vibratory element V has been caused to vibrate by striking it at the striking point on the line R—R with the striker head 60, the vibration at the point of attachment of the transmission cord TC on the line T—T is taken up by the transmission cord TC and transferred through the pick-up coupling ring 110 and the pick-up actuator rod 112 to the pick-up transmitter 113. The pick-up apparatus P converts the physical sound vibrations to electrical oscillations which are amplified by the amplifier A and reconverted into sound by the loud speaker LS.

A wide range of tones over the musical scale is possible in accordance with the use of vibratory elements V having suitable fundamentals.

I claim:

1. A musical instrument comprising a vibrant member having the characteristic of fundamental and overtone vibration, and a support for said member for supporting said member as a free pendant member, said support being secured to said member at a location spaced a short distance from a node of the fundamental vibration, and a device forming part of said support and attached to said vibrant member for transferring the physical vibrations of the member at the point of attachment of the device, structure spaced from said vibrant member for converting the transferred physical vibrations into electrical impulses, and amplifying devices therefor.

2. A musical instrument comprising a vibrant member having the characteristic of fundamental and overtone vibration, and a support for suspending said member in pendant position secured to said member, and a device forming part of said support for transferring the physical vibrations at the point of attachment.

3. A musical instrument comprising a vibrant member, and means for supporting said member, said means including a supporting cord and a vibration transmitting cord secured to said other cord.

4. A musical instrument comprising a vibrant

member, and means for supporting said member, said means including a supporting cord and a vibration transmitting cord secured to said other cord and to said member.

5. A musical instrument comprising a vibrant member, and means for supporting said member, said means including a cord secured to said member and a vibration transmitting cord secured to said other cord and to said member.

6. A musical instrument comprising a vibrant member and means for supporting said member, said means including a cord looped around said member, and supporting and vibration transmitting cords connected to said looped cord.

7. A musical instrument comprising a plurality of vibrant members, supporting means for said members attached thereto, a pick-up device, and means for transferring vibrations from said vibrant members at the place of attachment of the supporting means to said pick-up device, said transferring means comprising cords extending from said vibrant members to said pick-up device.

8. A musical instrument comprising a plurality of vibrant members, a pick-up device, means for transferring vibrations from said vibrant members to said pick-up device, said transferring means comprising cords extending from said vibrant members to said pick-up device, and an amplifier connected to said pick-up device.

9. A musical instrument comprising a freely pendant vibrant member, a device at a predetermined location along said member for setting up physical vibrations thereof, and a physical vibration take-off and transfer device secured to said member at a predetermined location, said predetermined locations being at places at which the fundamental vibration of the member has a small amplitude and overtone vibrations within the audible range have a larger and more effective amplitude.

10. A musical instrument comprising a freely pendant vibrant member, a device at a predetermined location along said member for setting up physical vibrations thereof, and a physical vibration take-off and transfer device secured to said member, the predetermined location being at a place along said member at which the fundamental vibration of the member has a small amplitude and overtone vibrations within the audible range have a larger and more effective amplitude.

11. A musical instrument comprising a freely pendant vibrant member, a device for setting up physical vibrations thereof, a physical vibration take-off and transfer device secured to said member at a predetermined location, said predetermined location being at a place along said member at which the fundamental vibration of the member has a small amplitude and overtone vibrations within the audible range have a larger and more effective amplitude.

12. In a musical instrument, a freely pendant vibrant member having the characteristic of vibration at fundamental and overtone frequencies, a device for setting up physical vibrations of a predetermined character in said vibrant member and in which the effect of the fundamental vibration is reduced and of overtones within the audible range is increased, said device including a striker located close to the node of the fundamental vibration of the vibrant member, and a physical vibration transfer device arranged at a predetermined location along said member, said location being close to a node of the fundamental vibration to suppress the effect thereof and

spaced from the nodes of overtone vibrations within the audible range to increase the effect thereof.

13. A musical instrument comprising a vibrant
5 member, and a support for said member spaced from one end of said member, said support including a cord extending around said member and secured thereto and having the ends extending outwardly therefrom, and a vibration transmitting cord secured to said other cord and oppositely disposed with respect to the outwardly extending portions of said other cord.

14. A musical instrument comprising a vibrant
15 member slightly elliptical in cross-section, and a support for said member spaced from one end of said member, said support including a cord extending around said member and secured thereto and having the ends extending outwardly therefrom, and a vibration transmitting cord secured to said other cord and oppositely disposed with respect to the outwardly extending portions of said other cord.

15. A musical instrument comprising a vibrant

member, and a support for said member spaced from one end of said member, said support including a cord extending around said member and secured thereto and having an end portion extending outwardly therefrom, and a vibration transmitting cord secured to said other cord and disposed with respect to the outwardly extending portion of said other cord at a point out of alinement with the central axis of the vibrant member.

16. A musical instrument comprising a vibrant member slightly elliptical in cross-section, and a support for said member spaced from one end of said member, said support including a cord extending around said member and secured thereto and having an end portion extending outwardly therefrom, and a vibration transmitting cord secured to said other cord and disposed with respect to the outwardly extending portion of said other cord at a point out of alinement with the central axis of the vibrant member.

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