

July 16, 1957

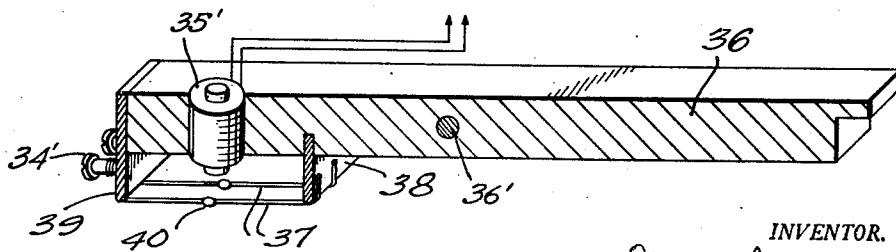
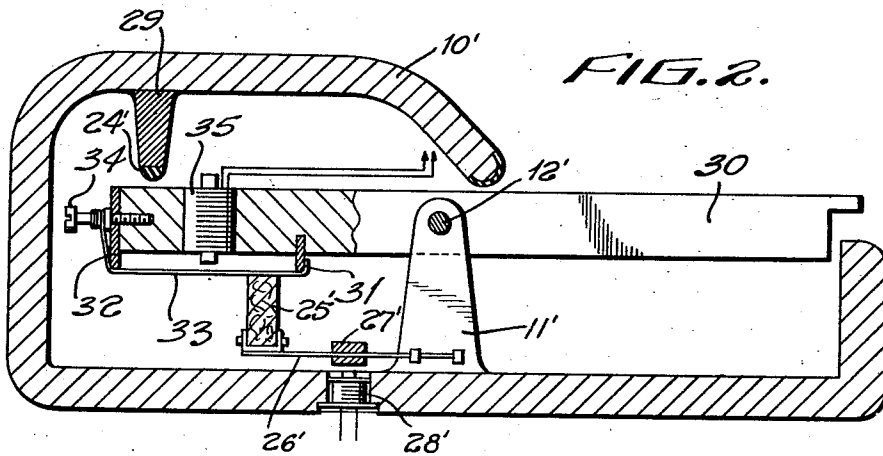
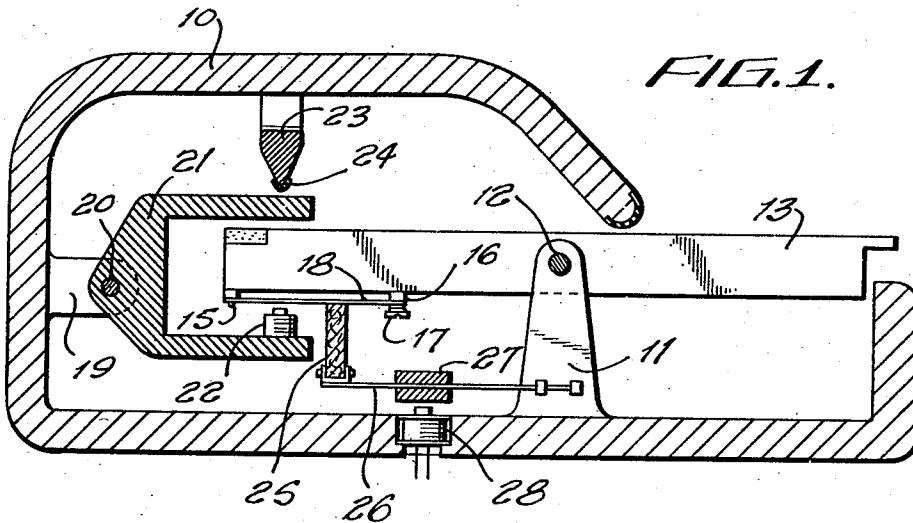
O. J. ALVAREZ

2,799,196

ELECTRICAL MUSICAL INSTRUMENT

Filed Nov. 12, 1952

3 Sheets-Sheet 1



INVENTOR.
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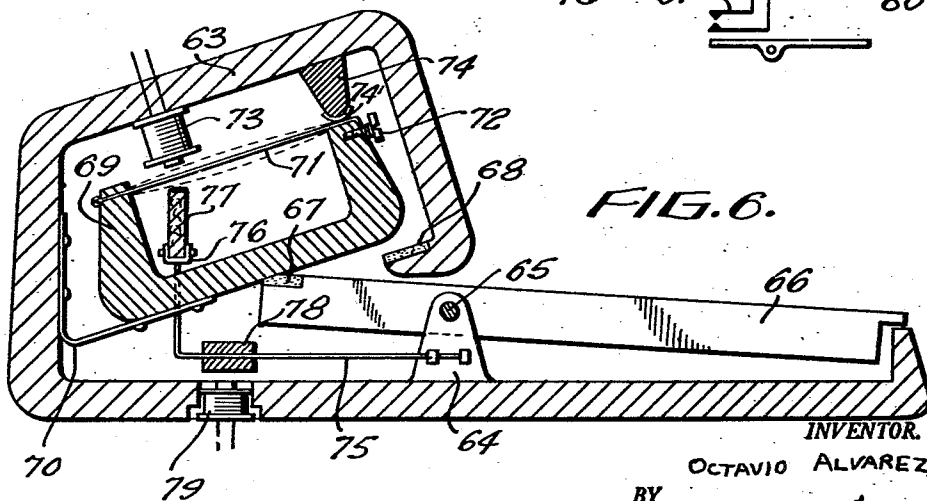
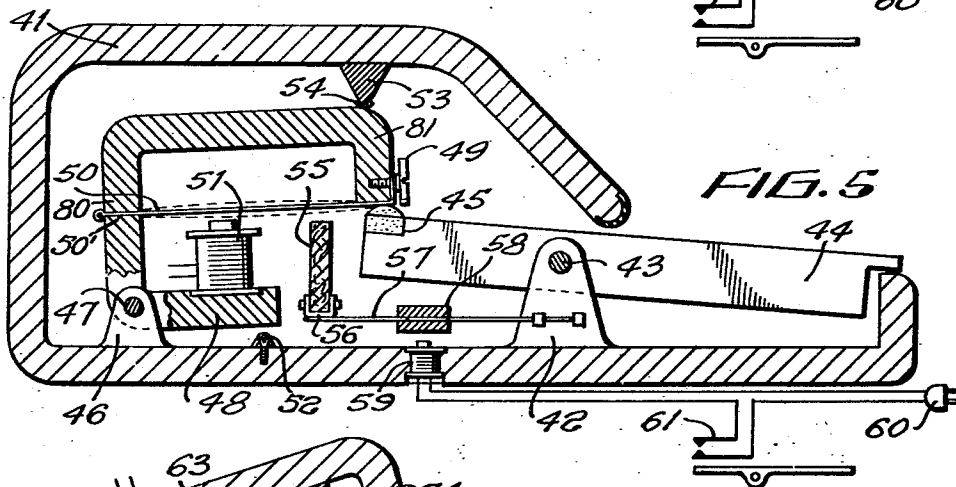
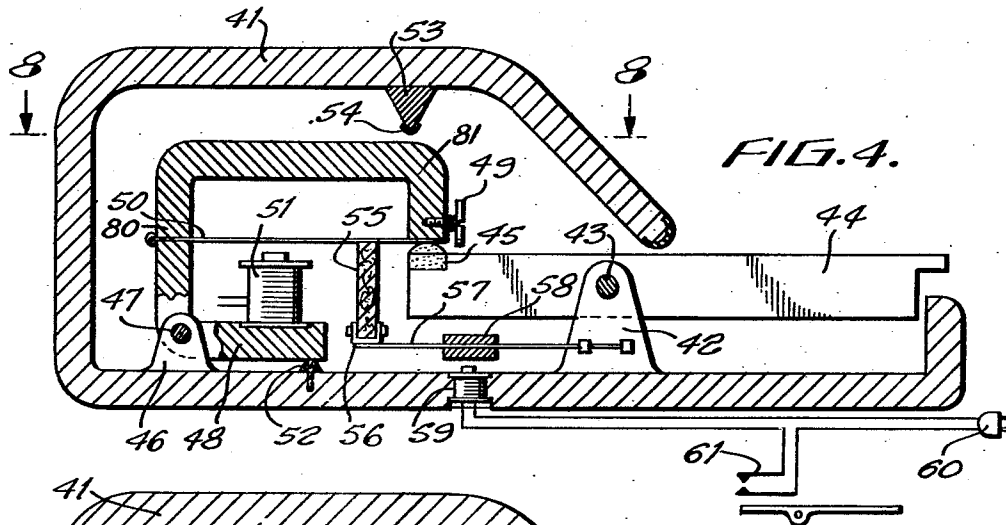
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ELECTRICAL MUSICAL INSTRUMENT

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3 Sheets-Sheet 2



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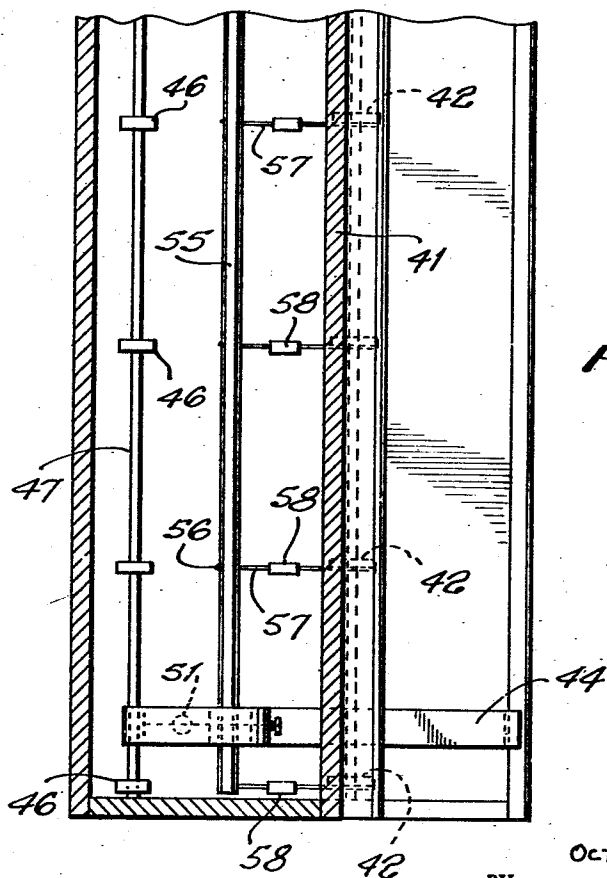
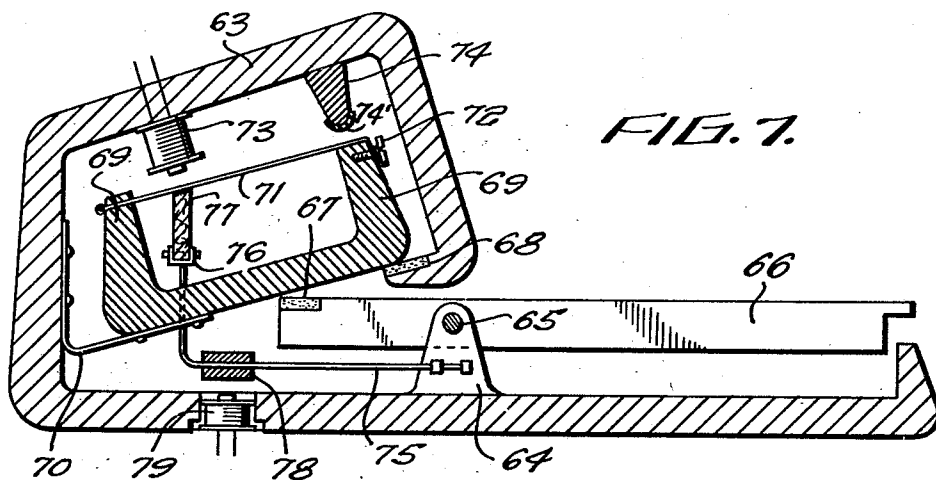
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ELECTRICAL MUSICAL INSTRUMENT

Filed Nov. 12, 1952

3 Sheets-Sheet 3



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ELECTRICAL MUSICAL INSTRUMENT

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16 Claims. (Cl. 84—1.04)

The present invention relates to musical instruments and in particular to stringed instruments.

A structure similar to that of the present invention is disclosed in U. S. Patent No. 2,486,545. The structure of this patent produces the sound by a vibrating steel reed which is associated with two sets of stationary coils.

One of the objects of the present invention is to provide a musical instrument with vibrating strings and a means for electrically picking up the vibrations of the strings to transform these vibrations into audible sounds.

A further object of the present invention is to provide a single set of coils to pick up the vibrations of the strings both when an operating key or the like has been depressed and when it is released.

Another object of the present invention is to provide a means for mounting the coils so that they are always in a predetermined relation with respect to the vibrating strings.

A still further object of the present invention is to provide a means for varying the tension of the vibrating strings.

Yet another object of the present invention is to provide a means for increasing the amplitude of the vibrations of the strings.

An additional object of the present invention is to provide an instrument capable of accomplishing all of the above objects while at the same time being made of relatively few, simple, ruggedly constructed parts.

With the above objects in view, the present invention mainly consists of a musical instrument which includes a support structure and a carrier structure mounted on the support structure for movement between a rest position and an operating position. A stop means is mounted on the support structure adjacent to the carrier structure and engages the latter when the carrier structure moves from its rest to its operating position, so as to impart vibrations to the carrier structure. An elongated vibrating member is fixed to the carrier structure and has two spaced points engaging the latter, this vibrating member being free between the spaced points thereof so as to vibrate between these points when the carrier structure strikes against the stop means upon movement of the carrier structure to its operating position. A pick-up means is provided on the carrier structure or the support structure and is located adjacent to the elongated vibrating member to pick up the vibrations thereof and transmit the same to an apparatus for changing the vibrations into an audible sound.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a side, sectional, partly diagrammatic view of one possible apparatus for carrying out the present invention;

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Fig. 2 is a partly diagrammatic, side, sectional view of another apparatus for carrying out the present invention;

Fig. 3 is a side, sectional view of a different embodiment of a part of the structure of Fig. 2;

Fig. 4 is a partly diagrammatic, side sectional view of still another embodiment of the present invention;

Fig. 5 illustrates the structure of Fig. 4 in a position different from that shown in Fig. 4;

Fig. 6 is a partly diagrammatic, side sectional view of a still further embodiment of the present invention;

Fig. 7 illustrates the structure of Fig. 6 in a position different from that shown in Fig. 6; and

Fig. 8 is a partly diagrammatic plan view taken along the line 8—8 of Fig. 4 in the direction of the arrows.

Referring now to the drawings, Fig. 1 shows a support 10 which e. g. extends horizontally along the length of a piano, or the like, this support 10 being shown in a transverse, vertical, sectional view in Fig. 1. In Fig. 1 is shown one of a plurality of key assemblies of an electrical musical instrument of the keyboard type. At spaced points along the length of the support 10 there are a number of stationary cars 11 which carry an elongated rod 12 extending along almost the entire length of the support 10. A plurality of elongated members in the form of keys 13, e. g. equal in number to the number of keys of a standard key board, are turnably mounted between their ends on the rod 12, as illustrated, these keys being located in side by side relation along the rod 12 and each having an outer free end portion accessible through an opening in the support 10 to the fingers of the operator of the instrument. Thus, ears 11 and rod 12 form a mounting means mounting each elongated member 13 for pivotal movement.

At its inner free end portion, each key 13 has fixed to its underside a pair of rigid members 15 and 16 forming a pair of string supporting means, and a screw 17 threadedly engages the member 16. An elongated vibrating member in the form of a stretched string 18 is fixed at one end to the member 15 and at its opposite end to the screw 17 so that the tension of string 18 may be adjusted by turning of screw 17. The several strings 18 which are respectively located on the keys 13 may vary as to length, thickness, and tension in proportion to conventional piano strings. The strings 18 may be made of a magnetic metal for a purpose to be described below.

A number of stationary ears 19 are located along the support 10 and are fixed to the inner rear face thereof, these ears 19 carrying an elongated rod 20 which extends along almost the entire length of the support 10. A plurality of C-shaped members 21 are turnably mounted on the rod 20, as shown in Fig. 1, and are equal in number to the number of keys 13 and located in side by side relation along the rod 20 respectively in alignment with the several keys 13. Each of the C-shaped members 21 includes an upper and a lower arm respectively located on opposite sides of the inner free end portion of the key 13 aligned therewith.

As is apparent from Fig. 1, the lower arm of the C-shaped member 21 is located at a greater distance from the key 13 than the upper arm of member 21, and an electrical pick-up means in the form of a coil 22 is fixedly mounted on this lower arm and is located closely adjacent to the string 18. Each of the members 21 is provided with a coil 22, and these coils are all electrically connected to an amplifier and loud speaker (not shown), in the same way as the coils shown in U. S. Patent Number 2,486,545.

An elongated stop bar 23 forms an abutment means and is fixed to the underside of the top part of the supporting casing 10, this bar 23 extending along almost the

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entire length of the support 10. A strip of elastic material such as felt or the like 24 is fixed to the bottom side of the bar 23. Thus, upon turning of a key 13 in a clockwise direction about rod 12, as viewed in Fig. 1, the inner free end portion thereof will engage the top arm of the C-shaped member 21 and turn the latter in a counterclockwise direction, as viewed in Fig. 1, until the top arm thereof strikes against the bar 23 so as to transmit vibrations through the member 21 and key 13 to the string 18 mounted on the latter. It will be seen that the coil 22 moves with the member 21 so as to be located close to the vibrating string 18 to pick up and transmit the vibrations thereof to an apparatus for changing these vibrations into an audible sound. Thus, the members 13 and 21 form a carrier structure for the string 18 and coil 22, this carrier structure being movable from the rest position illustrated in Fig. 1 to an operating position where the C-shaped member 21 engages stop bar 23 to set up vibrations in the string 18.

A damping means is associated with the strings 18 for damping the vibrations thereof. This damping means takes the form of an elongated strip 25 of felt or the like which extends along the entire length of support 10 beneath the strings 18. The strip 25 is carried by wire springs 26 which are respectively fixed to the ears 11 so as to urge the strip 25 to the position shown in Fig. 1 where it engages the strings 18 to damp out the vibrations thereof when the parts resume their rest position shown in Fig. 1.

A member 27 of a magnetic material is fixed to each of the springs 26, and an electromagnet 28 is located beneath each member 27, these electromagnets being mounted in the bottom wall of the casing 10 and being electrically operable, in a manner described below, by a pedal of the instrument. This structure forms an electromagnetic means for controlling the damping means. When this pedal is depressed, the electromagnets 28 are energized and attract the members 27 so as to move springs 26 downwardly to locate the strip 25 at a position lower than that shown in Fig. 1. In this way, the vibration of strings 18 will not be damped when the electromagnets 28 are energized, so that the vibrations of strings 18 will be continued to produce a long, drawn out tone.

Fig. 2 of the drawings illustrates a different embodiment of a key assembly of the invention which is in all respects the same as that of Fig. 1 except for the features which are now described. As is apparent from Fig. 2, the C-shaped member 21 and the parts 19 and 20 associated therewith are eliminated. Instead, the abutment means in the form of stop bar 29, identical with stop bar 23, is located directly over the inner end portions of the elongated members or keys 30 to engage the latter and directly set up vibrations in the same, stop bar 29 carrying a strip 24' of elastic material similar to strip 24. A pair of plates 31 and 32 are fixed to each of the keys 30 of the embodiment of Fig. 2, these plates forming a pair of string supporting means spaced longitudinally of member 30, and a string 33 is fixed at one end to plate 31, extends around the lower edge of plate 32, and is joined to a tuning screw 34 which passes through the plate 32 and threadedly engages a threaded bore in the key 30 so that the tension of string 33 may be adjusted by turning of screw 34. Thus, string 33 is stretched and extends between the pair of supporting means 31 and 32. A coil 35 is mounted directly on each key 30 opposite the free portion of string 33 located between the points thereof which engage the plates 31 and 32, so as to pick up the vibrations of the string 33 and transmit the same in the same way as was described above. Coil 35 thus forms a pick-up means carried by member 30 adjacent string 33, with a portion of pick-up means 35 located between the pair of supporting means 31 and 32. Except for these features, the structure of Fig. 2 is the same as that of Fig. 1, and it is evident that upon depression of the key 30, it will strike the bar 29 to produce vibrations in the string 33 which will be picked up by the coil 35. A damp-

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ing or string engaging means 25', 26' and an electromagnetic means 27', 28' for moving this damping means, identical with those of Fig. 1, are associated with the strings 33, as shown in Fig. 2. Fig. 2 also shows the support 10' and the mounting means 11', 12' pivotally mounting member 30 between its ends for turning movement about a predetermined axis. String 33 and the pair of supporting means 31 and 32 therefor as well as abutment means 29, 24' are all located on the same side of this axis, the abutment means being located opposite an upper face of member 30 adjacent an end of the latter.

Fig. 3 of the drawings shows a different type of string arrangement adapted to be used with the keys 36 identical with key 30. According to Fig. 3, a pair of strings 37 are each fixed at one end to a supporting means in the form of a plate 38 fixed to and extending from the underside of elongated member or key 36. These strings 37 extend about the lower edge of another supporting means in the form of a plate 39 fixed to the end of key 36, and each string 37 is connected to a tuning screw identical with screw 34 of Fig. 2. A weight 40 is mounted on each of the strings 37 to increase the amplitude of the vibrations thereof. Fig. 3 shows the pivotal mounting means 36', the pick-up means 35', and the tuning means 34'. Thus, when the structure of Fig. 3 is used, in the apparatus of Fig. 2, for example, the vibrations picked up by the coil will be the combined vibrations of two strings, and moreover the amplitude of these vibrations will be increased by the weights 40. It is to be understood that the feature of providing a plurality of strings in association with one key and the feature of providing a weight on a string are usable with the embodiments of Figs. 1 and 2, as well as with the further embodiments of the invention described below.

Fig. 4 of the drawings illustrates a further embodiment of a key assembly of the invention which includes an elongated support 41 similar to the support 10 described above. A number of ears 42 are fixed to the bottom wall of support 10 above the length thereof and carry a rod 43 on which the keys 44 are pivotally mounted. Each key 44 carries at its inner end portion a cushion member 45.

A number of additional ears 46 are fixed to the bottom wall of the support 41 and carry a rod 47 upon which a plurality of C-shaped elongated members 48 are turnably mounted, these members 48 being equal in number to the number of keys 44 and being respectively aligned therewith. Thus elements 46 and 47 form a mounting means turnably mounting the elongated member 48. Each member 48 is provided with a top arm having a downwardly extending free end located in engagement with the cushion 45 and threadedly carrying a tuning screw 49. A string 50 is connected to this tuning screw, extends about the free end of the top arm of member 48 and is fixed to the latter after passing through hole 50' at a point opposite this free end of the top arm thereof to provide string 50 with a free portion which is adapted to vibrate. The portions 80 and 81 of member 48 thus form a pair of string supporting means spaced longitudinally of member 48 and located at the ends thereof. A coil 51 forms a pick-up means carried by member 48 and is fixed to the lower arm of each member 48 and located closely adjacent to the string 50 to pick up the vibrations thereof and transmit the same to a sound producing apparatus, in the same way as was described above. The support 41 carries a rest 52 which engages the underside of member 48 when the parts are in the rest position shown in Fig. 4.

A stop bar 53 forms an abutment means and is fixed to the underside of the top wall of support 10 and extends over all of the members 48, this bar 53 being provided with an elastic strip of felt or the like 54 along its under surface. Thus, upon depression of key 44, the C-shaped member 48 aligned therewith turns to the position shown in Fig. 5 and strikes against the stop bar

53 to set up vibrations in the string 50 which are picked up by the coil 51.

A damping means identical with that described above is provided to damp out the vibrations of the strings 50. This damping means includes the elongated strip 55 of felt or the like mounted on a channel member 56 which is carried by a number of wire springs 57 fixed to the ears 42 (Fig. 8). Only one key 44 and its associated structure is shown in Fig. 8 for the sake of clarity. The springs 57 urge the strip 55 to the position shown in Figs. 4 and 5 so that the strings 50 engage the strip 55 when the parts are located in the position of Fig. 4 so as to thereby damp out the vibrations of the strings 50.

A number of magnetic members 58 are respectively mounted on the springs 57, and a number of electromagnets 59 are located in the bottom wall of support 41 respectively beneath the members 58. Elements 58 and 59 form an electromagnetic means for controlling the string engaging or damping means 55-57. The coils of electromagnets 59 are connected to a source of electricity through a plug 60, and the circuit of these coils includes a switch 61 operable by a foot pedal 62 which, upon being depressed, closes the switch 61 to complete a circuit through the electromagnets 59 which thereby attract the members 58 and pull the springs 57 and the strip 55 therewith to a position lower than that shown in Figs. 4 and 5, so that when the parts are in the position of Fig. 4, the vibrations of the strings 50 will not be damped and the tone produced thereby will be continued and drawn out. The parts 60-62 described above are associated with the electromagnets 28 of the embodiments of Figs. 1 and 2 to operate the same in exactly the same way.

A further embodiment of the invention is illustrated in Figs. 6 and 7 where the elongated support 63 carries ears 64 spaced along its length. Bar 74 carries an elastic strip 74' of felt or the like. A rod 65 is supported by the ears 64, and the keys 66 are pivoted on the rod 65, each key 66 having at its inner end a cushion member 67. A cushion member 68 is also provided on the support 63.

A plurality of upwardly directed C-shaped members 69 are each carried by a leaf spring 70 which is fixed to the inner rear face of support 63 and urges the members 69 to the position shown in Fig. 7 where they abut against the cushion 68 and maintain the keys 66 in the horizontal position illustrated in Fig. 7. A string 71 is fixed to the left free end of each member 69, as viewed in Figs. 6 and 7, and extends across the same and about the opposite free end thereof where each string 71 is connected to a tuning screw 72 threadably engaging the member 69 and being turnable to adjust the tension of each string 71.

A stationary pick-up coil 73 is mounted on the under surface of the top wall of support 63 in close proximity to the several strings 71, respectively, as is evident from Figs. 6 and 7. Also, a stop bar 74 is mounted on the underface of the top wall of support 63 opposite the right free end of member 69, as viewed in Figs. 6 and 7, so that when the key 66 is depressed, as shown in Fig. 6, the member 69 engages stop bar 74 to transmit vibrations to the string 71 which are picked up by the coil 73 and transmitted to an apparatus for changing the vibrations to an audible sound. The coils 73 are located close enough to the strings 71, when the parts are in the rest position shown in Fig. 7, to pick up the vibrations thereof after the key 66 is released.

A number of elongated wire springs 75 are respectively fixed to the several ears 64, two of these springs respectively being located at opposite ends of the row of C-shaped members 69 and the others of these wire springs each extending upwardly through a pair of adjacent members 69. The several springs support an upwardly directed, elongated channel member 76 which extends along almost the entire length of the support 63 and

which carries the felt strip 77 which engages the strings 71 when the parts are in the position shown in Fig. 7.

A number of magnetic numbers 78 are respectively mounted on the springs 75, and a number of electromagnets 79 are respectively located beneath the members 78 to attract the latter when the electromagnets 79 are energized so as to draw the springs 75 and the felt strip 77 therewith down to a position below that shown in Figs. 6 and 7 so that when the parts are in position of Fig. 7 the vibrations of the strings 71 will not be damped and the tone will therefore continue and be drawn out. The electromagnets 79 are energized by a structure identical with the parts 60-62 of Figs. 4 and 5. Thus, the embodiment of Figs. 6 and 7 is capable of accomplishing the same results as the above-described embodiments of the invention, although the pick-up coils 73 remain stationary.

It will be seen that in all embodiments of the invention the strings are shorter than the keys.

In the description above and in the claims which follow, the term "string" is intended to signify a metallic string for musical stringed instruments.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of musical instruments differing from the types described above.

While the invention has been illustrated and described as embodied in musical stringed instruments, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. An electrical musical instrument of the keyboard type having a plurality of key assemblies at least one of which comprises an elongated member, mounting means mounting said member for turning movement, a pair of string supporting means on said member spaced longitudinally thereof, a stretched string extending between said pair of supporting means, abutment means adjacent a portion of said member spaced from said mounting means and adapted to be contacted by said member during turning movement thereof, and electrical pick-up means on said member adjacent said string.

2. A musical instrument as recited in claim 1, wherein said abutment means is located adjacent an end portion of said member.

3. A musical instrument as recited in claim 1, said instrument including damping means located adjacent said string for damping vibration thereof.

4. A musical instrument as recited in claim 1, wherein a portion of said pick-up means is located between said pair of string supporting means.

5. A musical instrument as recited in claim 1, wherein a weight is carried by said string for influencing the vibration thereof.

6. A musical instrument as recited in claim 1, said elongated member having upper and lower faces and said abutment means being directed toward one of said faces adjacent an end of said member.

7. A musical instrument as recited in claim 1, wherein a string engaging means is located adjacent said string between said pair of supporting means for engaging a portion of the string located between said pair of supporting means.

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8. A musical instrument as recited in claim 1, wherein said abutment means is made at least in part of elastic material.

9. A musical instrument as recited in claim 1 and wherein said pick-up means is located between said pair of supporting means substantially nearer to one of said pair of supporting means than the other.

10. A musical instrument as recited in claim 1, wherein said member is a manually operable key and has a front end portion capable of being turned downwardly by the operator in order to cause said key to approach and engage said abutment means.

11. A musical instrument as recited in claim 10 and wherein said key has a pair of end faces and said mounting means is connected to said member between said end faces thereof.

12. A musical instrument as recited in claim 10, wherein said key is pivotally supported intermediate its ends.

13. A musical instrument as recited in claim 1, wherein said pair of string supporting means are respectively located at the ends of said elongated member.

14. A musical instrument as recited in claim 1, wherein said member is a manually operable key and wherein said mounting means pivotally supports said key intermediate its ends for turning movement about a predetermined axis, said pair of supporting means being located on one side of said axis.

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15. A musical instrument as recited in claim 14, wherein said abutment means is located adjacent an end of said key.

16. A musical instrument as recited in claim 15 wherein said abutment means is located on the same side of said axis as said pair of supporting means.

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