

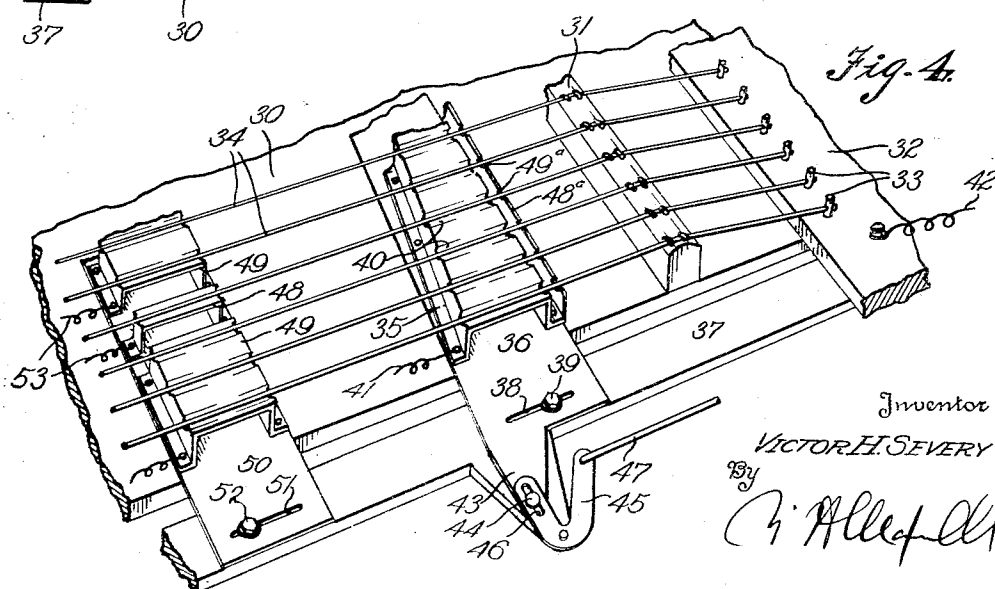
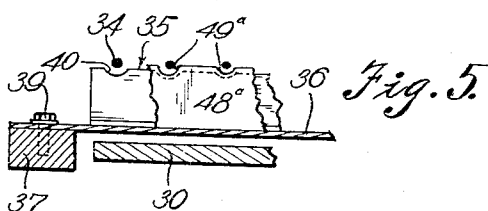
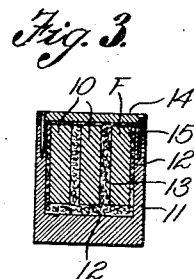
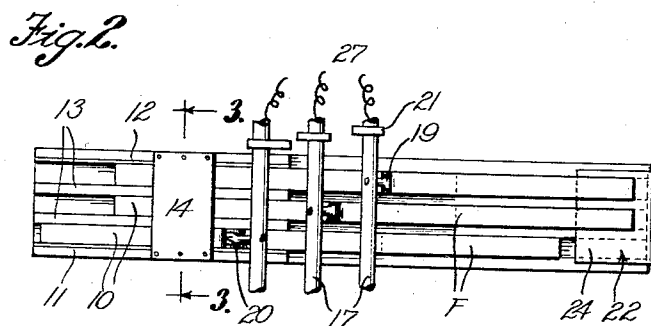
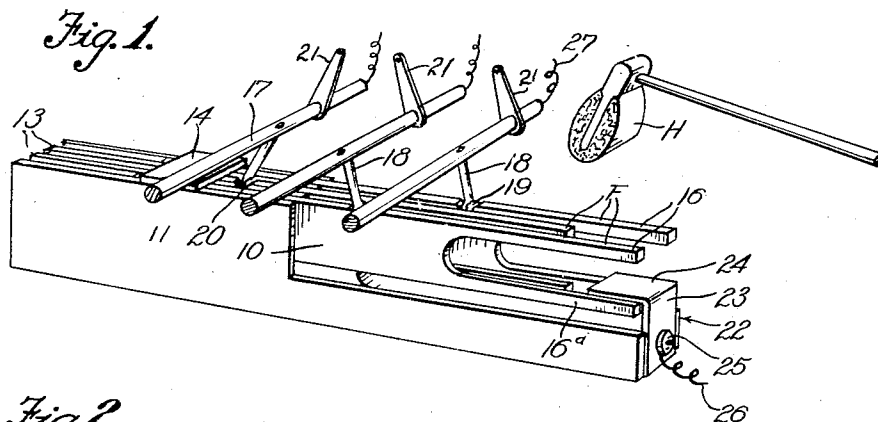
Nov. 14, 1939.

V. H. SEVERY
MUSICAL INSTRUMENT

2,180,122

Filed May 25, 1936

2 Sheets-Sheet 1



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2,180,122

MUSICAL INSTRUMENT

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2 Sheets-Sheet 2

Fig. 6.

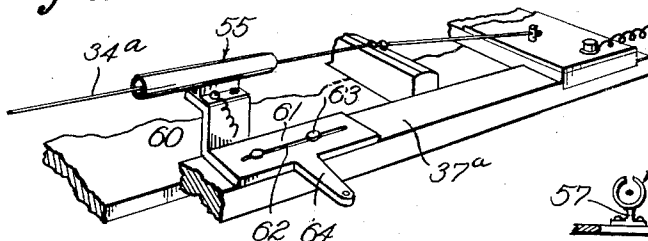


Fig. 10.

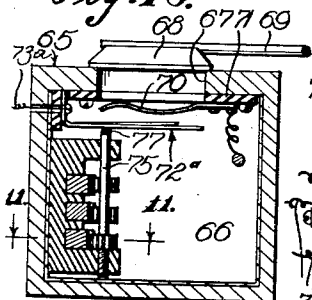


Fig. 9.

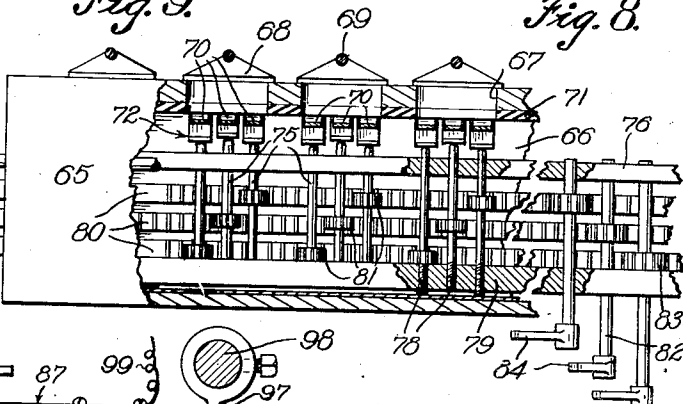


Fig. 8.

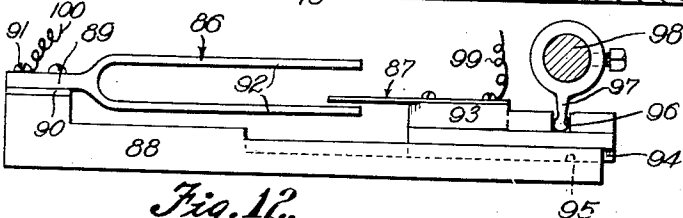


Fig. 12.

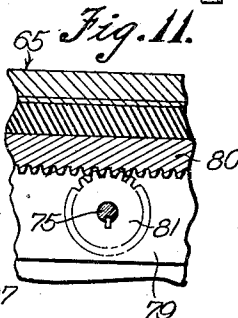


Fig. 11.

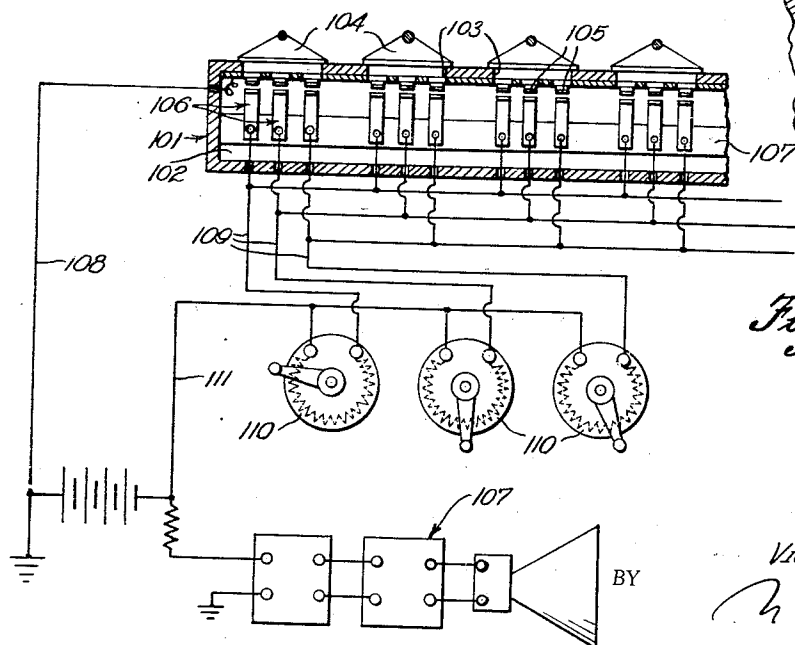


Fig. 13.

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2,180,122

MUSICAL INSTRUMENT

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Application May 25, 1936, Serial No. 81,674

3 Claims. (Cl. 84—1.14)

This invention relates to musical instruments and relates more particularly to musical instruments embodying electrostatic pick-up means. A general object of this invention is to provide a practical effective musical instrument of this character capable of producing tones in which a fundamental tone and its harmonics or partials may be selectively varied in intensity with respect to one another or eliminated at the will and option of the musician to effect very pleasing harmonic tone coloring.

It has long been recognized that the harmonics or partials attendant to the fundamental tones of an instrument give the instrument tones the timber or quality desired. In typical musical instruments, however, there is no means for individually controlling the intensities of these harmonics or partials. Accordingly, it is usually impossible to produce harmonic coloring of the tones of common musical instruments.

Another object of this invention is to provide a musical instrument embodying one or more electrostatic pick-ups for effecting the translation of the vibration of a sounder or sounders into modulations of an electrical current to be converted into sound by an amplifier and loud speaker unit, which instrument is characterized by selective means for varying the intensity of and for eliminating the harmonics or partials of the fundamentals whereby very effective tonal coloring may be obtained.

Another object of this invention is to provide a musical instrument comprising a plurality of related vibratile elements or sounders in the form of vibratory strings, reeds, forks, or the like related to respectively produce a fundamental tone and one or more of its partials, and one or more electrostatic pick-ups for the sounders and means for effecting relative movement between the sounders and the pick-ups to control or vary the intensity of the vibrations received by the pick-ups and thus produce practically any tonal coloring desired.

Another object of this invention is to provide a musical instrument of the character mentioned embodying a plurality of sounders representing a fundamental tone and its partials or harmonics, electrostatic pick-ups for translating the vibrations of the sounders into modulations of an electrical current and control means in the circuits of the pick-ups for varying the intensity of the said modulations and thus effect the desired tonal coloring.

Another object of this invention is to provide an electrical musical instrument of the char-

acter mentioned in which the effect of the sounders of the individual pick-ups or the intensities of the modulations of the circuits of the individual pick-ups may be selectively or individually varied at will to produce various tonal coloring effects.

Another object of this invention is to provide a musical instrument that may comprise a multiplicity of sounders such as vibratory strings, and electrostatic pick-ups so proportioned, formed and related to the strings as to facilitate the voicing of the instrument and to obtain the tonal effects resulting from the particular modes of the vibrating sounders.

Another object of this invention is to provide an electrical musical instrument of the character mentioned that is simple and that may comprise a single means for effecting the simultaneous vibration of a group of vibrating elements or sounders representing a fundamental tone and its partials.

Another object of this invention is to provide a musical instrument of the character mentioned in which the relative adjustment between the vibratile sounders and their electrostatic pick-ups may be effected from a remote point.

A further object of this invention is to provide a novel electrostatic pick-up for use in translating the vibrations of a vibratory string that is sensitive to or influenced by vibration of the string regardless of the direction of the vibration.

The various objects and features of my invention will be fully understood from the following detailed description of typical preferred forms and applications of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a perspective view of a group of vibratory forks and a pick-up as embodied in one typical form of the invention. Fig. 2 is a top or plan view of the group of forks illustrated in Fig. 1 of the drawings showing the forks in different relative positions. Fig. 3 is a transverse sectional view taken on line 3—3 on Fig. 2. Fig. 4 is a fragmentary perspective view of the strings and pick-ups of the invention embodied in a piano type instrument. Fig. 5 is an enlarged fragmentary vertical sectional view of the instrument illustrated in Fig. 4 showing the relationship between the insulator and the strings. Fig. 6 is a fragmentary perspective view of another form of the invention embodying a novel form of pick-up. Fig. 7 is a top or plan view of the pick-up illustrated in Fig. 6. Fig. 8

is a vertical detailed sectional view illustrating a multiplicity of pick-ups of the character illustrated in Figs. 6 and 7 in operative relation to vibratory strings. Fig. 9 is a fragmentary detailed sectional view of a form of the invention embodying vibratile reeds showing certain parts in elevation. Fig. 10 is a transverse detailed sectional view of a reed-type instrument embodying another form of electrostatic pick-up. Fig. 11 is an enlarged fragmentary detailed sectional view taken as indicated by line 11-11 on Fig. 10. Fig. 12 is a side elevation of a form of the invention embodying vibratile forks, and Fig. 13 is a fragmentary detailed sectional view of a reed-type instrument embodying controls in the circuits of the pick-ups, illustrating the circuits and associated parts in a diagrammatic manner.

The present invention is adapted to be embodied in or employed in instruments involving vibratile elements or sounders of various natures and may be varied somewhat when embodied in certain types of instruments. In the following detailed description I will describe several typical forms or examples of the invention as embodied in musical instruments having typical forms of sounders or vibration producing elements. It is to be understood that the invention is not to be construed as limited or restricted to the specific forms or details about to be described, but is to be taken as including any features or modifications that may fall within the scope of the claims.

The invention when considered broadly includes, generally, a vibratory element or sounder capable of producing the vibrations of a fundamental tone, one or more sounders capable of producing vibrations representing the harmonics or partials of the said fundamental tone, a pick-up unit or pick-up units related to the sounders to effect the translation of the vibration of the same into modulations in an electrical current and means for selectively varying the intensity of the modulations resulting from the vibration of the individual sounders or for eliminating the modulations resulting from the vibration of one or more of the sounders to obtain the desired tonal coloring, the last being effected either by relative adjustment between the sounders and pick-up or pick-ups, or by the control of the circuits of the pick-ups.

The invention as illustrated in Figs. 1, 2 and 3 of the drawings comprises a plurality of sounders or vibration producing elements in the form of vibratile forks F. The forks F are preferably arranged in a group to be simultaneously vibrated by a single hammer H, or the like, of reasonable proportions. There may be any suitable or desired number of groups of the forks F to comprise an instrument having a scale of any extent. In the illustrative example illustrated there are three forks F, one being formed to produce the vibrations of a fundamental tone, one being formed to produce the vibrations of a harmonic or partial of said tone, and the third being formed to produce the vibrations of another partial or harmonic of the fundamental tone. It will be obvious, of course, that there may be fewer or more forks F embodied in the group as desired, or necessary.

The forks F have their shanks 10 received in a suitable support. The support or carrier for the forks F may be in the form of a box or case 11 carrying sound and vibration insulating material such as felt 12 for contacting the lower edges and sides of the shanks 10. The shanks 10 of the

forks F are spaced apart by felts 13. A strap 14 extends across the top of the case 11 to prevent upward displacement of the shanks 10 and carries felt 15 which is engageable by the upper edges of the shanks 10. The forks F supported in this manner in the felt or insulation do not set up interfering vibrations within the case 11 and their vibrations are not excessively dampened or absorbed by their mounting means. As illustrated in the drawings the forks F are parallel and are in horizontal positions. The bifurcated end portions of the forks F project from a free or open end of a case 11 to be free for vibration and for engagement by the hammer H. The upper or outer arms 16 of the forks F are adapted to be simultaneously struck by the hammer H which may be operated by a suitable piano movement (not shown).

In the illustrative embodiment of the invention shown in Figs. 1, 2 and 3 of the drawings the forks F are shiftable or movable to effect the desired tonal coloring. The forks F mounted as described above have their shanks 10 shiftable longitudinally on the felt 12 and the felts 13 and are independently or individually movable. Various means may be utilized to selectively or individually shift the forks F. In the simple arrangement illustrated horizontal shafts 17 extend above the forks F in transverse relation thereto. Each shaft 17 carries a downwardly projecting arm 18. The arms 18 have suitable heads 19 received in notches 20 in the upper edges of the forks F. The shafts 17 are turnable and operating levers 21 project from the shafts to effect their rotation or turning. It will be apparent how suitable control means or shifting devices may be connected with the levers 21 to individually turn the shafts 17 to effect individual or selective adjustment of the forks F.

The simple embodiment of the invention illustrated in Figs. 1, 2 and 3 of the drawings includes, a relatively stationary electrostatic pick-up 22. The pick-up 22 is located to be influenced by or responsive to vibrations of the several forks F when they are in their extended or out positions. The pick-up 22 may be a simple member of electrical conducting non-magnetic material. The particular pick-up 22 illustrated is of substantially L-shaped cross section having a vertical arm 23 secured to an end of the case 11 and a horizontal arm 24 to extend inwardly over the end portions of the lower arms 16^a of the forks F. The pick-up arm 24 is of sufficient width to cover the end portions of each of the several fork arms 16^a. The pick-up arm 24 is relatively close to the plane of the fork arms 16^a but is positioned so that it is not engaged by the arms when they are in vibration.

The pick-up 22 is connected in a suitable amplifier and speaker circuit (not shown). A terminal 25 is provided on the pick-up 22 and a lead or conductor 26 extends from the terminal for connection in the amplifying circuit. Leads or conductors 27 are connected with the vibratile forks F. In practice the conductors 27 may be connected with the shafts 17 so that they are electrically connected with the forks F through the medium of the arms 18. The vibratile arms 16^a of the forks F when acting within the receptive range of the pick-up 22 comprise movable armatures to produce modulations in the circuit of the pick-up which modulations are truly representative of the vibrations of the forks F so that the pick-up 22 translates the vibrations of the forks F into electrical current modulations ca-

pable of reproduction as the true tones of the forks. The pick-up 22 and the adjacent parts are preferably shielded by a shield (not shown) of soft iron or magnetic iron to prevent external agencies from affecting the pick-up.

In the operation of the instrument illustrated in Figs. 1, 2 and 3 of the drawings let it be assumed that the pick-up 22 and the leads 27 are connected in a suitable amplifier and loud speaker circuit and that one fork F is adapted to produce the vibrations of a fundamental tone and that the other forks F are adapted to produce the vibrations of certain harmonics or partials of that tone. When the forks F are in the positions where their lower tines or arms 16^a have equal portions under the pick-up arm 24, vibration of the several tines, as by the hammer H, produces a compound tone composed of the fundamental and the two partials. The several forks F may be simultaneously vibrated by the single hammer H. As the pick-up arm 24 is disposed above the lower tines 16^a the impulse of the hammer blow on the forks giving its tines or arms extensive downward movement does not cause the lower arm 16^a to contact the pick-up arm 24. As above described, the arms of the forks F constitute the movable armatures of the pick-up 22 and when in vibration vary the potential in the pick-up field or gap and thus produce modulations in the electrical current of the pick-up circuit.

When it is desired to vary the coloring of the tone one or more of the forks F may be shifted longitudinally by means of the levers 21 to move their lower tines or arms 16^a with respect to the pick-up 22. For example, one fork F may be shifted to a position where its arm 16^a has a relatively small portion within the zone of receptivity of the pick-up 22, one fork F may be shifted to a position where its arm 16^a is entirely out of the field of reception of the pick-up 22, or the range of the hammer H, and the third fork, say the fundamental fork, may remain where its arm 16^a has a substantial portion within the field of the pick-up 22. Vibration of the forks F will then produce a tone characterized by a strong fundamental and one relatively light partial. The forks F may be individually moved to positions where they are not engageable by the hammer H and, therefore, are not vibrated with the other forks. It is believed that it will be apparent how the forks F may be shifted or adjusted at will to produce varied and pleasing coloring of the resultant tones. The forks F are supported in a manner so that their vibration is not appreciably dampened and so that there is no interference of the vibrations of one fork with the other, and no transference of vibration from one fork to the other. The forks F are arranged so that they may be readily adjusted or shifted at the pleasure of the musician from a remote point to effect the desired coloring of the tones.

Figs. 4 and 5 of the drawings illustrate a form of the invention applied to a stringed instrument. As shown in the drawings the instrument is of the piano type, it being understood that the invention contemplates the employment of this form of the invention on various other stringed instruments (not shown). The instrument structure illustrated in Figs. 4 and 5 of the drawings includes a suitable sounding board 30, a bridge 31 on the sounding board and a tail piece 32 spaced from the bridge 31 and carrying pegs or posts 33. A plurality of tensioned vibra-

tory strings 34 extends across the sounding board 30 and bears on the bridge 31. The ends of the strings 34 are secured by the posts 33. The strings 34 are preferably arranged in parallel relation in a common plane. The vibratory strings 34 may bear the same relationship as those of a piano or may bear any desired relationship. In the present instance it will be assumed that the strings 34 are graduated in diameter from one end of the series of strings to the other. The strings 34 are metallic and electrical conducting and may be of the type employed in pianos.

In accordance with the invention one or more electrostatic pick-ups are provided for each vibratory string 34. In the particular case illustrated in the drawings a pick-up 35 is arranged to extend transversely below the several strings 34 to be responsive to vibrations of the same. The pick-up 35 is supported by a shiftable or adjustable carrier 36. The carrier 36 has its opposite end portions bearing on suitable supports 37. Slots 38 are provided in the end portions of the carrier 36 and extend parallel with the strings 34. Screws or bolts 39 extend through the slots 38 to guide the carrier 36 and to permit the setting of the carrier in adjusted position, if desired. The pick-up 35 may extend transversely below the entire series of strings 34, however, as will be subsequently described, the invention contemplates the provision of individual pick-ups for the separate strings and pick-ups for groups of adjacent strings.

The pick-up 35 may be of any suitable electrical conducting nonmagnetic metal or may comprise a form of wood or material. The pick-up 35 is secured to the carrier 36 to have its upper surface adjacent the strings 34. In accordance with the invention grooves 40 are provided in the upper side of the pick-up 35 to directly oppose or to partially receive the vibratory strings 34 whereby the pick-up is more responsive to the multi-directional vibration of the strings. It is a feature of the invention that the pick-up 35 is tapered or of diminishing width to compensate for the differences in the frequencies of the vibrations of the strings of different diameters. In practice the pick-up 35 is of diminishing width from the lower large-diametered strings to the higher small-diametered strings to properly compensate for the increasing amplitude of the progressively higher strings.

A conductor or lead 41 extends from the electrostatic pick-up 35 to a suitable amplifying and loud speaker circuit (not shown). The strings 34 constitute the movable or vibratile armatures of the pick-up 35 and are connected in the amplifier and loud speaker circuit. The tail piece 32 may be of electrical conducting material and a common lead or ground lead 42 may be connected with the tail piece 32 so that the several strings 34 are connected in the amplifier and loud speaker circuit.

While the carrier 36 of the pick-up 35 may be directly moved and set in adjusted position by the bolts 39 to voice the instrument, the invention may provide means for shifting the carrier 36 from a remote point to provide for the chromatic variation of the tones as desired. In the typical construction illustrated lugs 43 project from the carrier 36 and carry pins 44. Bell cranks 45 are pivotally supported adjacent the lugs 43 and have slots 46 receiving the pins 44. The bell cranks 45 are adapted to be operated or pivoted by suitable operating rods 47.

The invention provides a novel safety device

or stop to prevent the contact of the vibratory strings 34 with the pick-up 35. In practice the stop 48^a is preferably arranged along the rear or outer side or edge of the pick-up 35. The stop 48^a projects above the upper surface of the pick-up 35 and has grooves or notches 49^a below or opposing the strings 34 whose walls are slightly above the walls of the grooves 40. In the event of excessive vibration of the strings 34 they may contact the stop 48^a and thus be prevented from contacting the pick-up 35 which would produce undesirable noise.

In accordance with the invention two or more pick-ups may be provided for each of the several strings 34. One pick-up, say the pick-up 35, may be located to be responsive to the strings 34 when vibrating in the fundamental mode while a second pick-up or a second set of pick-ups may be provided to be responsive to the harmonic vibrations of the strings. If desired, the second pick-up may comprise a single continuous structure similar to the pick-up 35. However, as shown in the drawings, there may be a single pick-up, as shown at 48, to be responsive to each individual string 34 and/or pick-ups 49 responsive to the vibration of two, three or more of the strings 34. The pick-ups 48 and 49 may be of the same construction and operation as the pick-up 35. The pick-ups 48 and 49 are supported by a carrier 50 similar to the carrier 36. The carrier 50 may have slots 51 in its end portions receiving bolts 52 whereby it may be shifted or adjusted and set in the adjusted positions. If desired, the carrier 50 supporting the pick-ups 48 and 49 may be shifted or moved from a remote point in the same manner as the carrier 36. Leads or conductors 53 extend from the pick-ups 48 and 49 to the circuit of a suitable amplifier and loud speaker. It is to be understood that the leads or conductors 41 and 53 may be individually controlled to cut out or vary the intensity of the tones produced by the action of the strings on the pick-ups.

In the operation of the instrument illustrated in Figs. 4 and 5 of the drawings the carriers 36 and 50 may be adjusted or shifted to voice the instrument as above described and then set in position by the bolts 39 and 52. If desired, however, the carriers 36 and 50 may be arranged to shift or move so that the pick-ups 35, 48 and 49 may be shifted at will. The strings 34 may be set in vibration in any suitable manner as by hammers or the like, and the vibration of the strings above the pick-ups produces modulations in the circuits of the pick-ups which modulations are converted into sound by the amplifying and loud speaker unit.

Figs. 6, 7 and 8 of the drawings illustrate a form of the invention embodying a novel improved type of electrostatic pick-up for association with vibratory strings. The sounders or strings 34^a may be arranged and supported above a sounding board in the same manner as the strings 34 shown in Figs. 4 and 5. As illustrated in Fig. 8 of the drawings the improved pick-ups 55 of the present invention are supported on a suitable carrier 56. The carrier 56 may be shiftable or adjustable in the same manner as the carriers 36 and 50. The pick-ups 55 illustrated in Figs. 7 and 8 are in the form of split tubes supported on individual bases 57. The bases 57 are secured to the carrier 56 to support the pick-ups 55 where the strings 34^a pass through them. The tubular pick-ups are sufficiently large in diameter to pass or receive the strings 34^a with

substantial clearance whereby the strings may vibrate without contacting the pick-ups. Each pick-up 35 is provided with a longitudinal slit 58 adapted to pass a string 34^a to facilitate the assembling of the instrument. The pick-ups 35 may be formed of electrical conducting non-magnetic material or other suitable material. Leads or conductors 59 connect the pick-ups 55 with a suitable amplifier and loud speaker circuit (not shown).

The sounders or strings 34^a constitute the movable armatures of the pick-ups 55 and may be connected in the amplifier and loud speaker in the same manner as the strings 34. Being tubular in form the pick-ups 55 substantially encompass the strings 34^a and therefore are operable to translate the vibrations of the strings into electric current modulations regardless of the direction of the vibrations. The lengths of the pick-ups 55 may be varied in accordance with the amplitude or diameter of the strings 34^a and if necessary may be varied in diameter for the same reason. The pick-ups 55 may be shifted longitudinally of the strings 34^a, by moving the carrier 56, to voice the instrument and to obtain the effect desired.

Fig. 6 of the drawings illustrates one of the pick-ups 55 carried by a bracket 60. The bracket 60 has a flange 61 shiftable along a support 37^a. A slot 62 is provided in the flange 61 and extends parallel with the adjacent string 34^a. Headed pins or screws 63 cooperate with the slot 62 to shiftablely guide the flange 61. An arm 64 projects from the flange 61 to facilitate the longitudinal adjustment of the pick-up 55. It is believed that it will be understood how the several pick-ups 55 may be supported for individual adjustment in the manner illustrated in Fig. 6 of the drawings if this procedure is desired.

Figs. 9, 10 and 11 of the drawings illustrate the invention embodied in a reed type instrument or an instrument where vibratory reeds constitute the sounders. The instrument illustrated in Figs. 9, 10 and 11 of the drawings includes a hollow case or body 65 having a chamber 66 for carrying air under pressure. Spaced outlet openings 67 are provided in a wall of the chamber 66 and are normally closed by valves 68. The valves 68 may be shifted or opened from a remote point by stems 69 and suitable operating parts (not shown).

In accordance with the invention a plurality of vibratile sounders are located adjacent each opening 67 to be vibrated by the outward passage of air through the openings. In the typical arrangement illustrated there are three reeds 70 extending across the inner end of each opening 67. The reeds 70 may be mounted on a suitable block 71 of electrical insulating material. Each group of reeds 70 comprises a reed capable of producing a vibration that is taken as a fundamental tone and the other reeds which produce partials of that fundamental tone. The invention provides flexible electrostatic pick-ups 72 for the sounders or reeds 70. In accordance with the invention a pick-up 72 is spaced inwardly from or below each reed 70. The pick-ups 72 may be flexible reed-like parts of electrical conducting non-magnetic material and are adapted to be connected with an amplifier and loud speaker circuit by suitable conductors 73. The reeds 70 constitute the armatures of the pick-ups 72 and are adapted to be connected with the amplifier and speaker unit by a common lead or ground lead 74.

It is a feature of the invention that the spacing of the pick-ups 72 with relation to the reeds 70 may be varied at the will of the musician to control the coloring of the tones produced. The pick-ups 72 may be formed and mounted to normally flex inwardly or away from the reeds 70. Push rods 75 are provided to urge or push the pick-ups 72 toward the reeds 70. The rods 75 are shiftable through openings in a support member 76 and contact the inner sides of the pick-ups 72. The push rods 75 have relatively steep threads cooperating with similar threads in openings 78 provided in a support member 79.

Means is provided for rotating the rods 75 to effect their longitudinal threading or movement for the purpose of shifting the pick-ups 72 relative to the reeds 70. A plurality of longitudinally shiftable racks 80 is provided in the body 65. The number of racks 80 corresponds to the number of pick-ups 72 provided at or adjacent each opening 67. Accordingly, in the case illustrated there are three spaced racks 80. Pinions 81 are keyed or fixed to the rods 75 and mesh with the racks 80. The pinions 81 of corresponding rods 75 mesh with corresponding racks 80. In other words, the pinions 81 on the rods 75 for shifting the pick-ups 72 oppose the fundamental tone reeds 70 mesh with the same rack 80, and the pinions 81 on the rods 75 for adjusting the pick-ups 72 opposition corresponding harmonic or partial reeds 70 mesh with the same racks 80. Operating shafts 82 are rotatable in openings in the members 76 and 79 and each shaft carries a pinion 83. The pinions 83 mesh with the racks 80 whereby one shaft 82 controls or moves a rack. Operating levers 84 are provided on the shafts 82 whereby the shafts may be turned from an adjacent or remote point. The conductors 73 may be electrically connected with the pick-ups 72 through the medium of the rods 75, pinions 81 and racks 80.

Fig. 10 of the drawings illustrates a type of pick-up 72^a that may be employed with the apparatus if desired. The reed 70 with which the pick-up 72^a is to be employed is first analyzed to find its leading or principal harmonic. The pick-up 72^a is in the form of a reed or a split reed and is turned to vibrate in sympathy to the reed 70. Vibration of the reed 70 when the valve 68 is opened results in vibration of the pick-up 72^a in harmony with and sympathy to the reed 70 effects modulations of the pick-up circuit to produce a very beautifully colored tone. Connections 73^a are electrically connected to the pick-up 72^a whereby they may be connected in a suitable amplifier and speaker circuit. The rods 72 may have tips 77 of insulation for contacting the pick-ups 72^a.

It is believed that the operation of the instrument illustrated in Figs. 9, 10 and 11 of the drawings will be understood from the foregoing detailed description. When a valve 68 is opened air under pressure from the chamber 66 rushes out through the opening 67 to effect vibration of the reeds 70 at that opening. Vibration of the reeds 70 if within the range of receptivity of the pick-ups 72 produces modulations in the circuits of the pick-ups which modulations may be translated into sound by a suitable amplifier and loud speaker unit. By manipulation or operation of the levers 84 the rods 75 may be shifted or threaded longitudinally to vary the spacing of the pick-ups 72 with respect to the reeds 70. In this manner the intensity of the modulations produced in the pick-up circuits by the funda-

mental reed and the harmonic reeds may be selectively governed. By adjustment or shifting of the pick-ups 72 with respect to the vibratory reeds 70 the musician may obtain practically any tonal coloring desired. If reed type pick-ups 72^a such as illustrated in Fig. 10 of the drawings are employed the tone is greatly enhanced by the sympathetic vibration of the pick-ups.

Fig. 12 of the drawings illustrates an instrument of the invention comprising a sounder in the form of a fork 86 and an electrostatic pick-up 87 shiftable relative to the fork 86. The fork 86 and the pick-up 87 may be supported on a suitable base or body 88. The shank 89 of the fork 86 is supported on the body 88 through suitable insulation such as felt 90 and is secured to the body by screws 91 or the like. The arms or tines 92 of the fork 86 project for free vibration. It will be obvious, of course, that the fork 86 may be actuated or vibrated in any suitable manner as by a hammer. The pick-up 87 comprises an elongate part of electrical conducting non-magnetic material. The pick-up 87 is secured to a block 93 to project above and in spaced parallel relation with one of the tines 92. In the arrangement illustrated the pick-up 87 is spaced slightly above the lower tine 92. The block 93 is shiftable on the body 88 to effect adjustment of the pick-up 87 relative to the tine 92. A key or tongue 94 is provided on the block 93 and shiftable operates in a groove 95 in the body 88.

The block 93 may be shifted between a position where the pick-up 87 is in close proximity to a substantial portion of the lower tine 92 and a position where it is removed or spaced from the tine 92 to be unaffected thereby. A notch 96 is provided in the block 93 and receives a lever 97. The lever 97 is carried by and operated by a shaft 98. The shaft 98 is adapted to be turned to shift or adjust the pick-up 87 relative to the lower tine 92 of the fork 86. A lead or electrical conductor 99 is provided to connect the electrostatic pick-up 87 with a suitable amplifier and loud speaker unit (not shown). The lower tine of the fork 86 comprises the movable armature or shiftable field member of the pick-up 87 and a conductor 100 is provided to connect the fork 86 with the amplifier and loud speaker unit. A plurality of sets of forks and pick-ups of the character just described may be provided to constitute an instrument having a complete scale.

The operation of the instrument illustrated in Fig. 12 of the drawings is substantially the same as that of the instrument illustrated in Figs. 1, 2 and 3 of the drawings. The pick-up 87 may be shifted by means of the shaft 98 to control or vary the intensity of the modulations imposed on the electrical circuit of the pick-up by vibration of the lower tine 92. In this manner various tonal colorings may be obtained.

Fig. 13 of the drawings illustrates an instrument of the invention wherein the translation of the vibration of reed type sounders into modulations of an electrical current may be governed by rheostat modulators to produce variations in the character or coloring of the tones.

The instrument shown in Fig. 13 includes a body 101 having a chamber 102 to which air under pressure is delivered. Spaced ports 103 occur in a wall of the chamber 102 and are normally closed by valves 104. The valves 104 may be opened or controlled from a remote point in the well known manner. A plurality of sounders in the form of reeds 105 is provided at the inner end of each opening 103. The reeds 105 may be

similar to the reeds 70. There may be three reeds 105 at each opening 103 to produce what may be considered a fundamental and two of its partials.

An electrostatic pick-up 106 is provided for each reed 105. The electrostatic pick-ups 106 may be carried by a suitable support 107 to be stationary relative to the reeds 105. The electrostatic pick-ups 106 may constitute bodies of electrical conducting non-magnetic material of the desired shape and size. The sounders or reeds 105 form the movable field members or armatures of the pick-ups 106 and are connected in the circuit of an amplifier and speaker unit 107 by a common conductor 108. Energized conductors 109 extend from the pick-ups 106. Modulators or variable rheostats 110 are interposed between the pick-ups 106 and the amplifier and loud speaker unit 107. The leads 109 of corresponding pick-ups 106 extend to the same rheostat 110. Where there are three pick-ups 106 at each opening 103 there are three variable rheostats 110. A lead or conductor 111 connects the rheostats 110 with the amplifier and loud speaker unit 107.

In the operation of the instrument illustrated in Fig. 13 of the drawings one or more of the valves 104 may be raised to permit the discharge of air through the openings 103 to effect vibration of the reeds 105. Vibration of the reeds 105 disturbs the electrical fields of the pick-ups 106 to produce modulations in the circuits of the pick-ups which modulations are imposed on the amplifier and loud speaker unit 107 to be produced as sound. The rheostats 110 may be governed or operated to vary the intensity of these modulations imposed upon the unit 107 by the fundamental tone producing reeds 105 or either of the partial producing reeds. Thus the rheostats 110 may be controlled to produce any desired coloring of the tones.

The above described instruments of the present invention, embodying the electrostatic pick-ups are far superior to the electrical musical instruments heretofore introduced employing electromagnetic pick-up weights or loads the sounder or vibrating element in a manner to lower its tone. Many attempts have been made to correct or compensate for this change in tone by the action of the electromagnetic pick-ups. However, this undesirable action of the electromagnetic pick-ups cannot be fully overcome because of the influence of the magnet or magnets on the material of the sounder or sounders. The electrostatic pick-ups employed in the instruments of the present invention do not in any way influence or load the vibrators or sounders. The above-described instruments embody means for effect-

ing adjustment between the sounders and the pick-ups to voice the instruments and if desired to produce practically any desired coloring of the resultant tones. Where three or more sounders or vibrators are employed to produce a tone the instruments of the invention embody means for selectively varying the intensities of the electrical modulations produced by the vibrations of the individual sounders. This selective adjustment is capable of effecting very desirable and beautiful coloring of the tones.

Having described only typical preferred forms and applications of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. In a musical instrument, a plurality of vibratile forks, one producing fundamental vibrations, the others producing vibrations which are the partials of said fundamental, an electrostatic pick-up receptive to vibrations of the forks to translate the vibrations into modulations in an electrical current, means supporting the forks for individual shifting relative to the pick-up comprising sound insulation supporting the forks and spacing them one from the other, and means for shifting the forks at the will of the player during the playing of the instrument.

2. In a musical instrument, the combination of a rigid support, a pick-up secured to said support, a plurality of vibratile forks of different pitch slidably mounted in the support, bearings formed of felt for supporting the forks and insulating them against vibration, means for simultaneously striking all of said forks to cause vibration of the same, and means actuated by the player during the playing of the instrument to slide the forks toward and away from the pick-up.

3. In a musical instrument, the combination of a box, bearings formed of felt mounted in said box, a plurality of vibratory forks having their shanks mounted in said bearings and arranged in parallel relation, rocker shafts mounted above the forks, means for connecting the respective shafts with the forks for sliding the same, means for manually actuating the rocker shafts, means for vibrating the forks, and an electrostatic pick-up mounted adjacent to the vibrating end of the forks and adapted to coact with the forks during the playing of an instrument whereby tones of different color may be produced by movement of the forks.

VICTOR H. SEVERY.