Feb. 6, 1945. Y. K. KEALOHA 2,368,842

MUSICAL INSTRUMENT

Filed Aug. 1, 1941

Fig. 1

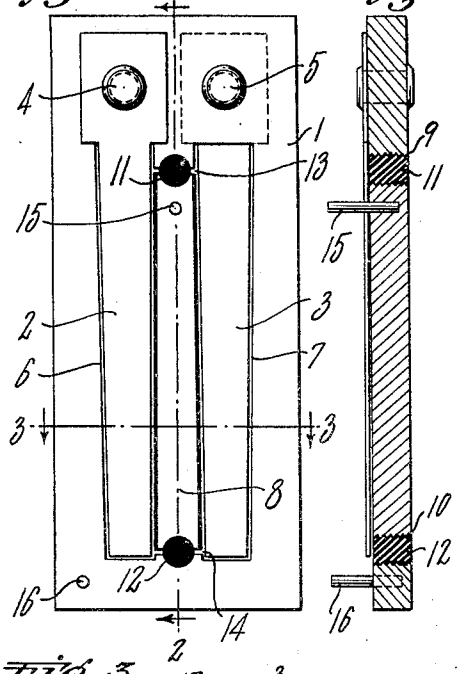


Fig. 2

Fig. 4

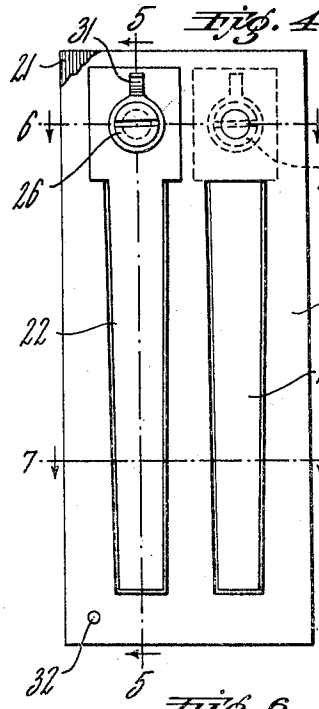


Fig. 5

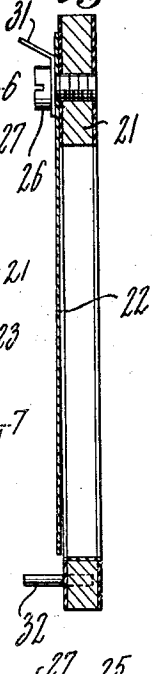


Fig. 3

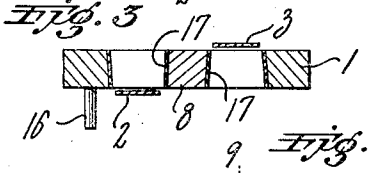


Fig. 6

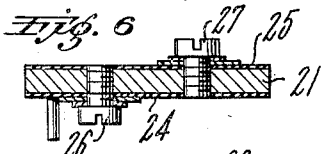


Fig. 7

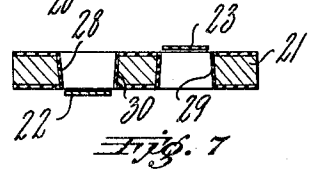


Fig. 8

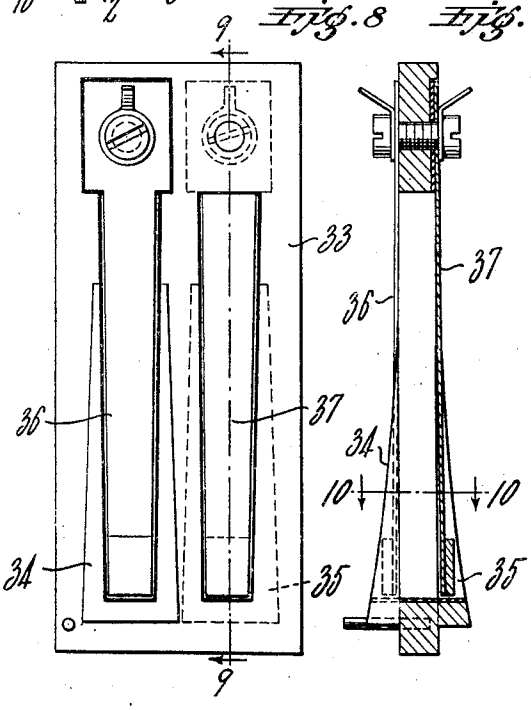
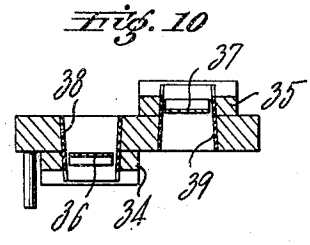


Fig. 9

Fig. 10



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MUSICAL INSTRUMENT

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7 Claims. (Cl. 84—1.14)

This invention relates to a musical instrument of the reed type, and more particularly to a means and a method of providing for the translation of the vibration of the reed or of each reed where a plurality are present as in the accordion, into electrical impulses which may be amplified in any well known manner, so that when the instrument is played with the amplifying means in use, the volume will be greatly increased.

It is among the objects of the invention to bring out the pleasing timbre of a reed instrument such as an accordion by the full reproduction of all overtones or harmonics which are present in conjunction with the fundamental vibration of the reed. Methods hereto provided for the electrical amplification of the sounds generated by the reeds have not been fully satisfactory, due to the inability to pickup and reproduce all of these harmonics or overtones in addition to the fundamental vibration.

It is among the objects of the present invention to provide an electrical pickup for a reed instrument which will reproduce the tones of the vibrating reeds throughout their full range and with high fidelity.

It is a further object of the present invention to provide an electrical pickup of such nature and arrangement that the high tones produced by the small reeds and the low tones produced by the larger reeds will be amplified in their true intensities so that neither the high notes nor the low notes will be suppressed or weakened relative to the other, to the end that all of the tones will be reproduced with greatly increased intensity but that all will bear the same relative intensities that they possess when the electrical amplification is not used.

In prior attempts to provide an electric pickup for accordions considerable difficulty has been encountered due to the large number of reeds involved, and the relatively close spacing of the same in the instrument. This spacing is such, and the surrounding casing so confined, that there is no room for the introduction of electrical equipment requiring any material amount of space.

It is among the objects of this invention to provide an electrical pickup which involves no material increase in the weight of the accordion and which requires no increase in the space surrounding the wind box, but can be applied to accordions as at present constructed.

Attempts have heretofore been made to overcome some of the above-mentioned difficulties and provide an electro-static pickup by means of a plate mounted adjacent to and in a plane parallel with the vibrating reeds. This plate is connected to one source of electrical potential or to ground while the reeds are connected to another and different potential. In such constructions, the charged plate is necessarily mounted at a sufficient distance from the reeds to permit the same to vibrate freely. The capacity of the condenser so formed is, therefore, limited due to the distance between the plate and the reed.

It is primarily the object of the present invention to provide a construction in which the plate upon which the reed is mounted, or a portion thereof, is utilized as one of a pair of condenser plates, while the vibrating reed itself acts as the other. The small clearance between the plate and the reed, which is normally provided to permit the free vibration of the reed into and out of the usual perforations in the plate, is thus the limit of the distance between the plate and the reed and the determining factor in the condenser-effect obtainable for any given difference in electrical potential.

It will be understood that the perforations in the plate adjacent which the reeds are mounted and through which they vibrate, are tapered toward the reeds and it is necessary that the clearance between the plate and the reed be very small, normally of the order of 0.001 to 0.0015 of an inch to avoid any unnecessary air leakage between the reed and the plate. In the course of the vibration of the reed this clearance is, of course, increased as the reed moves into the tapered perforation. This small normal clearance may be somewhat enlarged for the purpose of electrification in order that a sufficient clearance may be provided between the reed and oppositely charged plate to the end that leakage of electrical current therebetween will be avoided. However, by the provision of adequate insulation the arrangement of which will be hereinafter described, the necessity for any alteration in the clearance between the reed and the plate may be largely avoided.

The above and other objects of the present invention will be apparent to those skilled in the art from a consideration of the following detailed description taken in conjunction with the accompanying drawing in which:

Figure 1 represents a top plan view of a reed plate, having a pair of reeds mounted thereon in the usual manner, but having a portion thereof electrically insulated from the remainder of

the plate and from the reeds in accordance with this invention.

Figure 2 represents a longitudinal section taken on the line 2—2 of Figure 1.

Figure 3 is a transverse section taken upon line 3—3 of Figure 1.

Figure 4 is a view corresponding to Figure 1 of a modified form of the invention.

Figure 5 is a section taken upon line 5—5 of Figure 4.

Figure 6 is a transverse section taken on line 6—6 of Figure 4, and Figure 7 is a transverse section taken on line 7—7 of Figure 4.

Figure 8 is a view corresponding to Figure 1 of a further modified form.

Figure 9 is a longitudinal section taken on line 9—9 of Figure 8, and Figure 10 represents a transverse section taken upon line 10—10 of Figure 9.

Referring to Figure 1, reference numeral 1 indicates one of the reed plates of an accordion. It will be understood that, except for the alterations hereinafter noted, this reed plate is of conventional construction and that the remaining reed plates of the accordion, of which there may be any number mounted upon the usual bridge block, are substantially identical in structure except for the size thereof which will vary from the high notes requiring relatively small reeds, to the low notes requiring relatively large reeds. A pair of reeds 2 and 3 are mounted in the usual manner on opposite sides of the plate 1 by means of pins or rivets 4 and 5. As in conventional structures the reeds 2 and 3 vibrate in and adjacent to oblong openings 6 and 7 provided in the plate structure 1. As will be readily understood by those skilled in the art, a very small but uniform clearance is provided between the reeds 2 and 3, and the side walls of the openings 6 and 7. Between the two cut-out portions or perforations 6 and 7 a bar 8 of the original plate material remains. In the normal structure, the center bar 8 is accordingly integral with the remaining portion of the plate structure 1. In accordance with the present invention, however, a bore 9 is cut or punched in the center bar 8 at a point adjacent the fixed ends of the reeds 2 and 3, and a similar bore 10 is cut or punched through the center bar 8 at a point adjacent the free ends of the reeds. Rods of hard insulating material 11 and 12, of such external diameter as to provide a very tight fit with the bores 9 and 10 forced or drawn thereinto under considerable pressure. In order to increase the grip of the insulating rods 11 and 12 upon the side walls of the bores 9 and 10 it is preferable, though not essential, to provide the rods with screw threaded or corrugated surfaces which, when forced into bores having slightly less diameter than the overall diameter of rod and thread, provide a very secure grip such that the rod cannot be subsequently removed by the application of any force to which the plate is likely to be subjected while in use. After the rods 11 and 12 are securely in place, a thin cut 13 is made through the bar 8 to the rod 13 at each side thereof, and similar cuts 14 are made through the bar 8 to the insulating rod 12.

By this operation the center bar 8 is entirely insulated from the remainder of the plate 1 without in any way disturbing its position relative thereto, and accordingly without disturbing the very small clearance between the edges of the reeds 2 and 3 and the center bar. The structure remains entirely rigid. That is, the center bar 8 does not tend to slip into or out of its position but remains as fixed as it was originally through all ordinary handling. The space formed by the cuts 13 and 14 forms a suitable insulating gap between the bar 8 and the remainder of the plate 1. These gaps may be filled with insulating material if desired. A conducting pin 15 is provided in the center bar 8, and a similar conducting pin 16 is provided in the body portion of the plate 1. It will thus be seen that when the conducting pin 15 is connected to one pole of a source of current or positive potential, and the remaining pin 16 is connected to the opposite pole of the same source, or to ground the metallic reeds 2 and 3, which are conductively connected to the plate, will be at one potential, while the center bar 8 is at a different potential. The structure, therefore, forms a condenser having center bar 8 forming one plate thereof positioned between oppositely charged plates formed by reeds 2 and 3. Vibration of either of the reeds 2 and 3 will vary the effective capacity of the condenser and since the condenser effect exists throughout the full length of the vibrating portion of the reed it will be seen that the variation in condenser effect will include both the fundamental vibration and all overtones.

It will be understood that the electrical connection to the pin 15 will preferably be in the form of a bus-bar which extends across a plurality of the plates 1, and connects all, or any desired number of similar bars 8 of any set to the same source of potential, while the pin 16 is likewise connected to a similar bus-bar connecting all, or any desired number of the plates 1 to a source of negative potential, or to ground. Thus the only increase in weight in the accordion to which the invention is applied is the negligible weight of the two bus-bars forming the two electrical connections for all of the plates.

While the gap or clearance between the reeds 2 and 3, and the bar 8 may be relied upon to provide a sufficient insulating gap between the reeds and the bar 8, it is sometimes desirable to apply a thin coating of insulating material 17 on the side walls of the bar 8 adjacent the reeds 2 and 3 to insure that any dust particles coming between reeds and the bar will not provide a direct conducting path therebetween. Since, in this form of the invention only the bar 8 is at a different potential from the reeds it serves no electrical function to apply insulation to the other side walls of the openings 6 and 7, however, since in the process of manufacture the insulation is conveniently applied with a brush it may be simultaneously applied to both sides of the openings 6 and 7 thereby insuring that the clearance between the reed and the opening is the same upon both sides of the reed.

Referring to the modified form of the invention as shown in Figures 4, 5, 6 and 7, the reed plate 21 carries the reeds 22 and 23 which are mounted upon opposite sides thereof, and insulated therefrom by the sheets of insulating material 24 and 25, which, for the sake of convenience of construction and for the purpose of providing insulation between the reed and the side wall of the perforation along the line of the least clearance there-between, may cover the entire surface area of each face of the plate or at least that portion thereof adjacent the perforations. As shown, the reeds are attached rigidly to the plate by means of screw bolts 26 and 27 of insulating material. It will be understood that any suitable fastening means, such as rivets or pins,

may be used for this purpose, provided the same are adequately insulated to avoid any electrical connection between the reeds and the plate. When so constructed the free ends of the reeds 22 and 23 may vibrate freely into the openings or oblong perforations 28 and 29 of the plate 21 from which they may be insulated by a thin coating of insulating material 30, sprayed or otherwise formed on the internal walls of the openings for the purpose of preventing any electrical connection between the edges of the reeds 22 and 23 and the reed plate 21. However, since there is normally a slight clearance between the edges of the reeds 22 and 23 and the internal wall of the opening as the reed vibrates therein, it is possible to rely merely upon this air gap without insulation of the side walls of the openings, provided the difference in electrical potential between the plate 21 and the reeds 22 and 23 is not too great.

The reeds 22 and 23 are connected to a suitable source of electrical potential by metallic tabs 31, which have a suitable surface area in contact with the reeds preferably at the point of fixation thereof. Each of the tabs 31 is connected to a suitable bus-bar common to all of the reeds. Plate 21 is connected by suitable pin 32 to a different source of electrical potential or to ground by way of a suitable bus-bar common to all of the plates.

The operation of the above-described modification will be obvious from the consideration of the operation on the form previously described in connection with Figures 1, 2 and 3 and, obviously, this form will provide a greater condenser effect, for the same difference in potential between the plate and the reeds, than the form shown in Figure 1.

The form shown in Figures 8, 9 and 10 is similar in many respects to the form shown in Figure 4 et seq. except that the plate 33 is provided with a wedge-shaped portion, 34 and 35, surrounding the free ends of the reeds 36 and 37, so that the ends of the reeds which move through a greater distance than the mid portion of the reeds, are throughout their period of vibration in close proximity to the oppositely charged surface area, the same as exists when the reed vibrates into the opening or perforations 38 and 39, as when it is outside or beyond this opening—this arrangement insures a somewhat greater capacity effect in the outermost position of the vibrating reed.

Having thus described the invention I claim:

1. An electrical pick-up for a musical instrument of the type including a vibrating reed mounted upon a metallic plate, means whereby said reed is electrically insulated from a portion of said plate and means connecting said reed and said portion of said plate to different electrical potentials in an amplifying circuit.

2. In a musical instrument, a condenser, said condenser comprising a reed secured at one end to a metallic plate, the remaining portion of the reed extending contiguous to the plate and being free for unrestricted vibration, said reed forming one electrode of the condenser and said plate forming the opposite electrode of the condenser.

3. In a musical instrument of the type having a plurality of vibrating reeds rigidly attached at one end thereof to a metallic plate, means for electrically insulating said reeds from said plate and means for connecting said reeds and said plate to sources of different electrical potentials in an amplifying circuit.

4. In a musical instrument of the type having a plurality of vibrating reeds rigidly attached to the opposite faces of a perforated plate, means for electrically insulating a portion of said plate between said perforations from the remainder thereof and means for connecting the two portions of the plate thus insulated from each other to sources of different electrical potentials in an amplifying circuit.

5. In a musical instrument of the type having a vibrating reed rigidly attached to a face of a perforated, metallic plate and having its other end free for vibration into said perforation, means comprising a thin sheet of insulating material between said plate and said reed for electrically insulating the same, said sheet extending over the surface of said plate adjacent the edge of said perforation, and means for connecting said reed and said plate to different electrical potentials in an amplifying circuit.

6. An electrical pick up for a musical instrument of the reed type, including in combination, a metallic plate having a perforated portion, a metallic reed rigidly attached at one end thereof to a face of said plate and having its other end free for vibration into and adjacent said perforated portion, means for electrically insulating said reed from said plate, and means for connecting said reed and said plate to sources of different electrical potentials in an amplifying circuit, whereby said reed forms one electrode of an electrical condenser and said plate forms the opposite electrode of said condenser.

7. In a musical instrument, a metallic reed mounted for vibration, a metallic member adjacent said reed and extending along the length thereof and in the same general plane as that of said reed when the same is in its stationary position, means for electrically insulating said reed from said member and means for connecting said reed and said member to different electrical potentials in an amplifying circuit, whereby said reed forms one electrode of an electrical condenser and said member forms the opposite electrode of said condenser.

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