Feb. 20, 1951 V. I. ZUCK 2,542,611

PICKUP FOR ELECTRIC ORGANS

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Fig. 1.

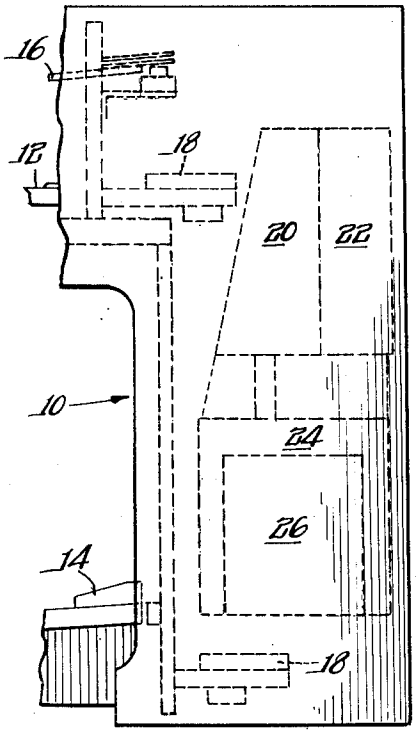

Fig. 2.

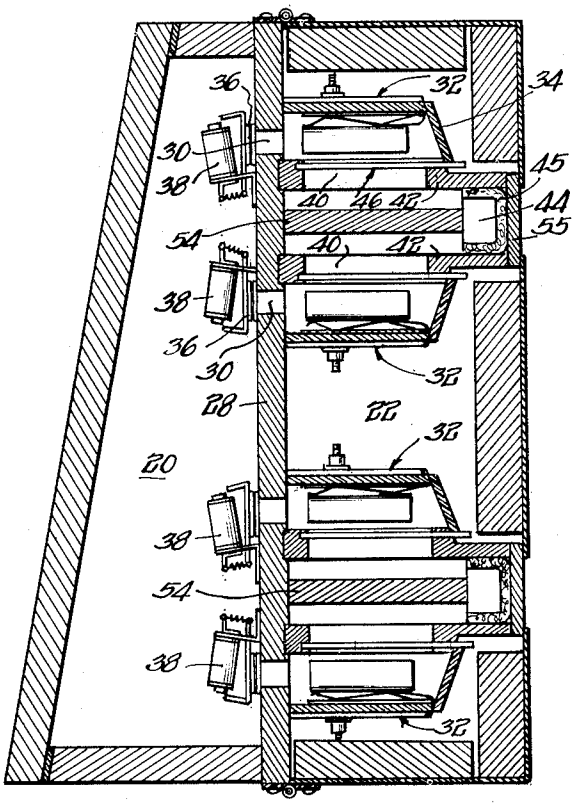

Fig. 3.

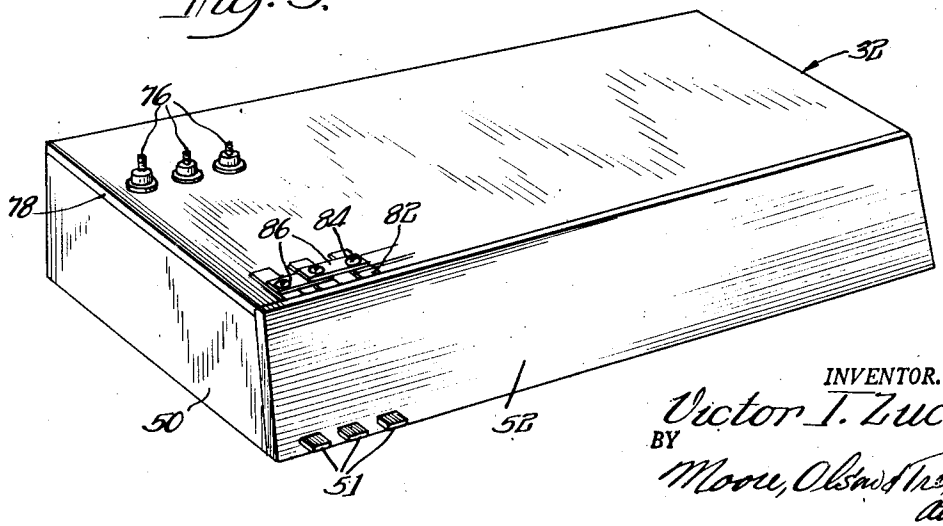

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Fig. 4.

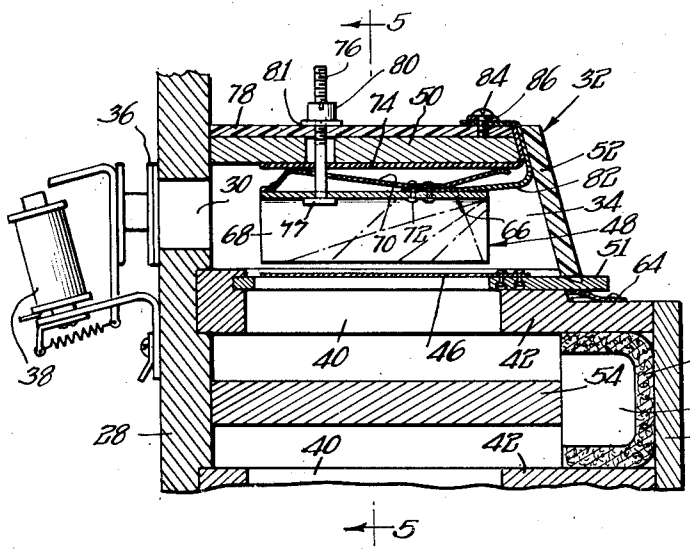


Fig. 5.

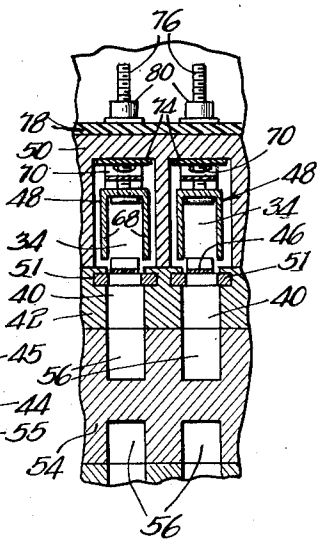


Fig. 6.

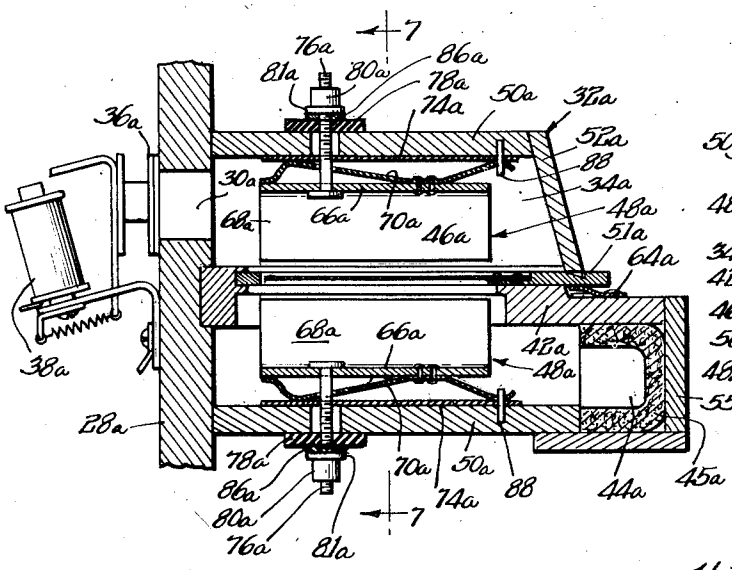
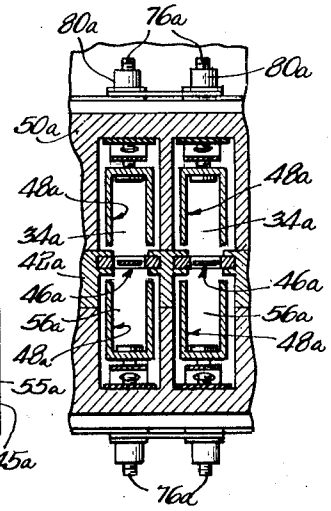


Fig. 7.



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PICKUP FOR ELECTRIC ORGANS

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14 Claims. (Cl. 84—1.14)

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The present invention pertains in general to electric organs, and, in particular, to organs of the air-driven reed type employing capacitative pickup elements to translate the reed movements into corresponding electrical signals which are amplified and reproduced by a loudspeaker.

In general, the amplitude of vibration of the reeds in an organ of the type described is relatively small. Consequently, it is convenient to employ pickup elements in the form of small condenser plates disposed substantially parallel to the reeds and located a short distance therefrom as a satisfactory means for generating electrical signals in response to the vibration of the reeds. In the case of very low tones, however, the usual construction of the pickup elements has been found unsatisfactory because the relatively large amplitude of vibration of the reeds tends to produce such abrupt and erratic changes in capacity throughout each cycle of vibration that the desired relation between reed movement and pickup voltage is impaired. Under such conditions the low tones present in a given gamut or stop of similarly produced notes are reproduced less faithfully than are the higher tones, causing the low tones to be out of character with the remainder of the notes in the selected stop.

It is an object of this invention to improve the design and construction of the capacitative pickup elements in a vibrating reed type of electric organ in such manner as will greatly facilitate the production of notes having uniform tone quality throughout each selected stop. To this end I provide stationary condenser plates of novel form which are adapted to maintain the desired capacitative relation with their cooperating reeds notwithstanding the large amplitude of vibration of the reeds in the lower tones.

A further object is to provide an improved condenser plate or shell of channel cross-section within which the vibrating reed may swing whereby the constrast between signal intensities at different portions of the cycle of vibration is kept within certain desired limits.

A still further object is to provide improved pickup means for a vibrating reed type of electric organ wherein the distribution of capacity between a vibrating reed and its stationary condenser plate may be conveniently adjusted by varying the shape of the plate, thereby to vary the tone quality of the note produced.

The above and other objects, features and advantages of the invention will be apparent from a study of the following specification, when taken in conjunction with the accompanying drawings, wherein:

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Fig. 1 is a partial side elevational view of an air-driven reed type electric organ to which the principles of the present invention are applicable;

Fig. 2 is an enlarged transverse sectional view of the wind chest and reed frame of the organ shown in Fig. 1;

Fig. 3 is a perspective view of one of a number of blocks of reed cells which are included in the reed frame;

Fig. 4 is a transverse sectional view of a reed cell illustrating details of the capacitative pickup elements which are disposed therein;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 4;

Fig. 6 is a transverse sectional view of a reed cell equipped with a modified pickup arrangement; and

Fig. 7 is a fragmentary sectional view taken along the line 7—7 in Fig. 6.

The electric organ 10 shown in Fig. 1 comprises one or more keyboards 12, a pedal board 14 and a set of stop tablets 16. The keys and pedals of the organ are mechanically connected to groups of multi-contact electrical switches, or coupler board assemblies, 18 extending lengthwise of the organ rearwardly of the keyboard and pedal board. The coupler board assemblies 18 are interconnected with the stop tablets in such manner as to energize pallet operating magnets, disposed within a wind chest 20, in accordance with the joint operation of the stop tablets and the organ keys or pedals. The pallets operated by the magnets control the flow of air from the wind chest 20 to the reeds, which are disposed within a reed frame 22. The wind chest 20 is continuously supplied with compressed air from a compressor 24 during operation of the organ. The reeds disposed in the reed frame 22 each have a capacitative pickup element associated therewith, which elements are connected to the input circuit of a thermionic amplifier 26 so as to deliver electric signals thereto corresponding to the reed vibrations. The output circuit of the amplifier 26 is connected to a loudspeaker (not shown), which converts the electrical signals into audible tones.

Referring now more in particular to Figs. 2 through 5, the wind chest 20 and reed frame 22 are separated by a pallet board 28 having horizontal rows of openings 30 extending therethrough. Reed blocks 32 are aligned with the horizontal rows of openings in the pallet board 28, each of the reed blocks having a row of reed cells 34 formed therein and respectively aligned with the openings 30. The pallet board openings

30 normally are closed by pallets 36 which are attached to the armatures of pallet magnets 38.

Whenever one of the pallet magnets is energized, through the joint operation of a stop tablet and an organ key, it attracts its armature to uncover its associated opening or port 30. Air then flows from the wind chest 20 into the reed cell 34 which corresponds to the operated stop tablet and organ key. The air thus admitted to the selected reed cell 34 flows out through an opening 40 in a reed board 42 and thence through an acoustically lined passage 44 extending lengthwise of the organ to an exit port (not shown). In its passage through the reed cell 34 and opening 40, the air passes over a reed 46, causing it to be set into vibration. The vibration of the reed 46 produces a variation in capacity between the reed and a pickup element 48 mounted in the reed cell 34, this effect being then utilized to produce electrical signals which are fed to the amplifier 26 of the organ.

The construction of the capacitative pickup elements and the reed cells in which they are disposed is shown in detail in Figs. 4 and 5. The reed cells 34 may be formed by cutting a row of transverse grooves in a wooden member 50, which extends lengthwise of the organ and is glued or otherwise secured to the pallet board 28 with the aforesaid grooves in alignment with the openings 30 in the pallet board. The lower surface of the wooden member 50 is glued or otherwise secured to the reed board 42, with the aforesaid grooves in the member 50 aligned with the openings 40 provided in the reed board. The reed board 42 may be recessed into the pallet board 28, as shown, for added rigidity. The reed board 42 is adapted to receive the reed pouches 51 which carry the reeds 46. A mute strip 52 is secured to the member 50 in any preferred manner so as to close the reed cells 34 formed therein and to hold the reed pouches firmly in place. The mute strip 52, being in contact with the pickup elements, is formed of suitable insulating material such as plastic.

For the sake of compactness and economy, the reed blocks 32 preferably are arranged in vertically stacked pairs, Fig. 2, with the lowermost reed block of each pair disposed in inverted position. Wooden strips 55 extend lengthwise of and are glued or otherwise secured to the reed boards 42 of each pair of reed blocks 32 to form exhaust passages 44, each of which is common to a pair of reed blocks. The exhaust passages 44 are lined with sound-absorbing material 45 to absorb the acoustical energy in the exhaust air. A baffle board 54, Figs. 2 and 4, is provided between each pair of reed blocks 32 to avoid interference between the reeds included therein. The baffle boards 54 are provided with transversely extending grooves 56, Fig. 5, in their upper and lower surfaces, which grooves form passages for conveying air from the openings 40 in the reed boards 42 to the exhaust passages 44.

Each of the reeds 46 comprises an elongated vibratory element which is anchored at one end thereof as by being riveted to the reed frame or pouch 51. In accordance with common practice the reeds 46 are electrically conductive in order that each reed may be employed as one element of a condenser, and hence the reeds usually are made of metal such as brass. These reeds 46 are electrically connected to a suitable source of potential through the reed pouches 51, which also are conductive, and through metallic strips 64, the latter extending lengthwise of the reed boards 42 and being provided with contact arms to engage the undersides of the reed pouches 51 at the heel ends thereof.

The capacitative pickup elements 48 comprise channel-like members, or shells, which are formed of sheet metal, preferably phosphor bronze suitably plated to prevent corrosion, and which constitute stationary condenser plates for cooperation with the movable condenser plates afforded by the reeds 46. Each of the shells 48 includes a rectangular web or body portion 66 and a pair of flanges 68 extending normally thereto along the longer sides thereof. The flanges 68 are spaced apart a distance slightly greater than the width of the cooperating reed 46. The pickup shells 48 are positioned in the reed cells 34 in alignment with the reeds with which they are associated and with the edges of the flanges 68 disposed in close proximity to and extending along the edges of the reeds 46, whereby the reeds are enabled to vibrate between the flanges 68 without interference.

The shells 48 are biased toward the reeds 46 by bowed leaf springs 70, which are attached to the web portions 66 by rivets 72 and bear against the ceilings of the reed cells 34. To insure adequate insulation such as might not be afforded by the wooden member 50 alone, non-conductive strips 74 of insulating material such as plastic are disposed within the reed cells 34 between the pickup elements and the member 50. The insulating strips 74 are formed over at one end and extend through notches provided along one edge of the member 50 for a purpose to be described hereinafter.

The pickup shells 48 are supported by adjusting screws 76 each of which is provided with a head 77 that is attached to the shell 48 by soldering or the like. The screws 76 extend through clearance openings in the leaf springs 70, the insulating strips 74, the member 50, and a second insulating strip 78 covering the outer surface of the member 50. Adjusting nuts 80 threaded on the exposed portions of the screws 76 bear against lock washers 81 which are seated on the strip 78. This arrangement enables the position of each pickup shell 48 to be adjusted individually relative to its reed 46.

The pickup elements are supported also by resilient metal strips 82, which are secured thereto between the leaf springs 70 and the web portions 66 by the rivets 72. These metal strips 82 extend over the insulating strips 74 and through the notches provided in the edge of member 50, thence extending over the insulating strip 78 to which they are secured by screws 84 that are threaded into the insulating strip. The strips 82 are employed to connect the pickup elements to the amplifier circuit 26 through a bus bar 86 (Fig. 3) which may consist of a plurality of links, each extending between an adjacent pair of the screws 84. It will be understood that Fig. 3 depicts only a few of the terminal screws 84 and adjusting screws 76 that actually are mounted on a reed block 32.

The form of pickup element herein shown and described enables a considerable variation to be obtained in the characteristics of the electrical signals which are produced in response to vibrations of the reeds. Thus, the shapes of the flanges 68 are important in determining the waveform of the electrical signal which is generated through a variation of the capacity between each pickup shell 48 and its reed 46. These flange portions may be shaped in a variety

of forms such as indicated by broken lines in Fig. 4 to determine the tone quality of the reproduced musical note in accordance with the character of the organ stop to which the note corresponds. The quality of the tone also may be regulated to some extent by rotating the adjusting nut 80 to move the pickup shell 48 closer to or farther from the reed. Further variations of tone quality may be obtained by forming the strip 82 supporting the pickup shell 48 near the fixed end of the reed. These additional adjustments will afford a small variation of tone quality to compensate for manufacturing variations.

One of the advantages of my invention is that it enables tones of uniform quality to be reproduced from all of the vibrating reeds in each organ stop. It also enables tones of predetermined quality to be obtained simply by shaping a stationary condenser plate in lieu of more complicated methods heretofore regarded as necessary. The difficulty which formerly attended the production of satisfactory low tones in the vibrating reed type of electric organ is hereby eliminated. The invention further serves to increase the number of tone combinations which can be made available in the design of the organ.

A modified form of the invention wherein each reed cooperates with a pair of oppositely arranged pickup shells for the purpose of further reducing tone distortion is illustrated in Figs. 6 and 7. The reed block 32*a*, shown in these views, is constructed in a manner very similar to the block 32 described hereinabove. Therefore, similar reference characters distinguished by the suffix letter "*a*" have been employed to denote corresponding parts in the second embodiment of the invention. Two pickup shells 48*a* are symmetrically located with respect to each of the reeds 46*a*. These pickup shells are formed in the same manner as the pickup shells 48 in Fig. 4 and are mounted in the reed cells 34*a* in a manner similar to that heretofore described. The baffle board 54 and the resilient strips 82 of Figs. 4 and 5 have been omitted in the embodiment of Figs. 6 and 7. Pins 88, each of which anchors a leaf spring 70*a* at one end thereof to a wooden member 50*a*, serve to maintain the pickup shells 48*a* in alignment with the reeds 46*a*; also, in Fig. 6, the bus bars 86*a* are electrically connected to the pickup shells 48*a* through the screws 76*a*, thereby eliminating the need for the resilient strips 82 of Fig. 4. Thus, it is not necessary to notch an edge of each wooden member 50*a*, and the mute strip 52*a* may be formed of a material such as wood which is cheaper or more convenient to use than materials such as plastic having better insulating properties.

Where a pair of pickup elements is associated with each reed, as illustrated in Figs. 6 and 7, the pickup elements may be coupled to the amplifier 26, Fig. 1, through a push-pull type of input circuit. Such circuits are familiar to those skilled in the art and are employed to eliminate even-harmonic distortion. In the present instance, such an arrangement is effective to reduce the distortion which results from the discrepancy between the actual variation of capacity with reed movement as compared with a true linear relationship. This enables a wider tonal range to be covered, particularly in the lower tones, without sacrificing uniformity of timbre of all the notes included in a stop. As in the case of the embodiment shown in Figs. 4 and 5, the pickup shells 48*a* have flanges 68*a* that may be shaped to produce the desired tone quality of the musical note which is reproduced from the vibration of the reed.

While particular embodiments of the invention have been shown and described herein, other modifications obviously can be made, and therefore it is intended that the appended claims cover all such variations as come within the true spirit and scope of the invention.

The invention is hereby claimed as follows:

1. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pickup element capacitatively coupled to said reed, said element having a surface spaced from and lying substantially parallel to the reed and intersecting a plane of vibration of said reed and a flat surface disposed substantially parallel to the direction of vibration of said reed and positioned to one side thereof, said surfaces disposed at an angle less than a straight angle.

2. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pickup element capacitatively coupled to said reed, said element having a surface spaced from and lying substantially parallel to the reed and intersecting a plane of vibration of said reed and a pair of spaced flat surfaces each disposed substantially parallel to the direction of vibration of said reed and positioned on either side thereof, said spaced surfaces disposed relative to said first named surface at an angle less than a straight angle.

3. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a channel-shaped pickup shell capacitatively coupled to said reed, said shell being positioned in alignment with said reed and with the direction of vibration thereof and having flanged portions the edges of which are disposed in proximity to the edges of said reed.

4. In an electric organ, a conductive vibratory reed, and a pickup element capacitatively coupled to said reed, said element having a body portion the area of which overlaps the area of said reed and a flange portion angular thereto extending substantially parallel to the direction of vibration of said reed and adapted to be shaped for producing a predetermined tone quality in the musical note reproduced from vibration of said reed.

5. In an electric organ having an amplifier, a reed comprising a conductive strip secured at one end thereof, and a pair of pickup elements of channel shape capacitatively coupled to said reed and adapted to cooperate in feeding pickup signals to said amplifier.

6. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pair of pickup elements formed of sheet material capacitatively coupled to said reed and lying on opposite sides thereof substantially in the direction of vibration of the reed, said elements having flat surfaces disposed substantially co-planar and parallel to the direction of vibration of said reed and positioned to one side thereof.

7. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pair of pickup shells capacitatively coupled to said reed, each of said shells including a pair of spaced flange portions disposed substantially parallel to the direction of vibration of said reed and positioned on either side thereof, and a body portion joining said flange portions intermediate the ends thereof and substantially parallel to said reed.

8. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pair of channel-shaped pickup shells capacitatively coupled to said reed, said shells being symmetrically positioned relative to said reed on opposite sides thereof and each having flanged portions located in proximity to the edges of the reed.

9. In an electric organ, a conductive vibratory reed, and a pair of channel-shaped pickup shells capacitatively coupled in opposed relation to said reed, each of said shells being adapted to embrace said reed during a portion of each cycle of vibration thereof.

10. In an electric organ having an amplifier, a pair of channel-like stationary condenser shells, means supporting said shells in opposed spaced relation, and a conductive vibratory reed mounted intermediate said shells and capacitatively coupled thereto, said shells being adapted to cooperate in feeding pickup signals to said amplifier and being shaped to produce a predetermined tone quality of the musical note reproduced from the vibration of said reed.

11. In an electric organ, a conductive vibratory reed, and a pair of pickup shells capacitatively coupled to and partially overlying said reed in mutually opposed relation thereto, each of said shells having a body portion and an angularly disposed flange portion extending substantially parallel to the direction of vibration of said reed and adapted to be shaped for producing a predetermined tone quality in the musical note reproduced from vibration of said reed.

12. In an electric organ, a reed comprising a conductive strip secured at one end thereof, and a pickup element capacitatively coupled to said reed, said element having a relatively flat body portion lying spaced from and substantially parallel to and co-extensive with the reed, and a relatively flat flange portion depending from one edge of the body portion and lying in a plane substantially parallel to the direction of vibration of said reed and positioned adjacent one edge thereof.

13. In an electric organ, a conductive vibratory reed supported at one end of its longitudinal axis, and a pickup shell capacitatively coupled to said reed, said shell having a body portion spaced from and lying substantially parallel to the longitudinal axis of the reed, and flange portions extending from the body portion and angularly disposed in respect thereto adapted to be shaped for producing a predetermined tone quality of the musical note reproduced from the vibration of said reed.

14. In an electric organ, a conductive vibratory reed supported at one end of its longitudinal axis, and a flanged pickup shell capacitatively coupled to said reed, said shell being channel-shaped in transverse cross section, the longitudinal axes of the shell and reed being parallel, and the shell being arranged to embrace said reed during at least a portion of each cycle of vibration thereof.

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