

Feb. 16, 1943.

W. B. LA CHICOTTE, JR

2,311,399

ELECTRIC PIANO

Filed Nov. 30, 1940

2 Sheets-Sheet 1

*Fig. 1.*

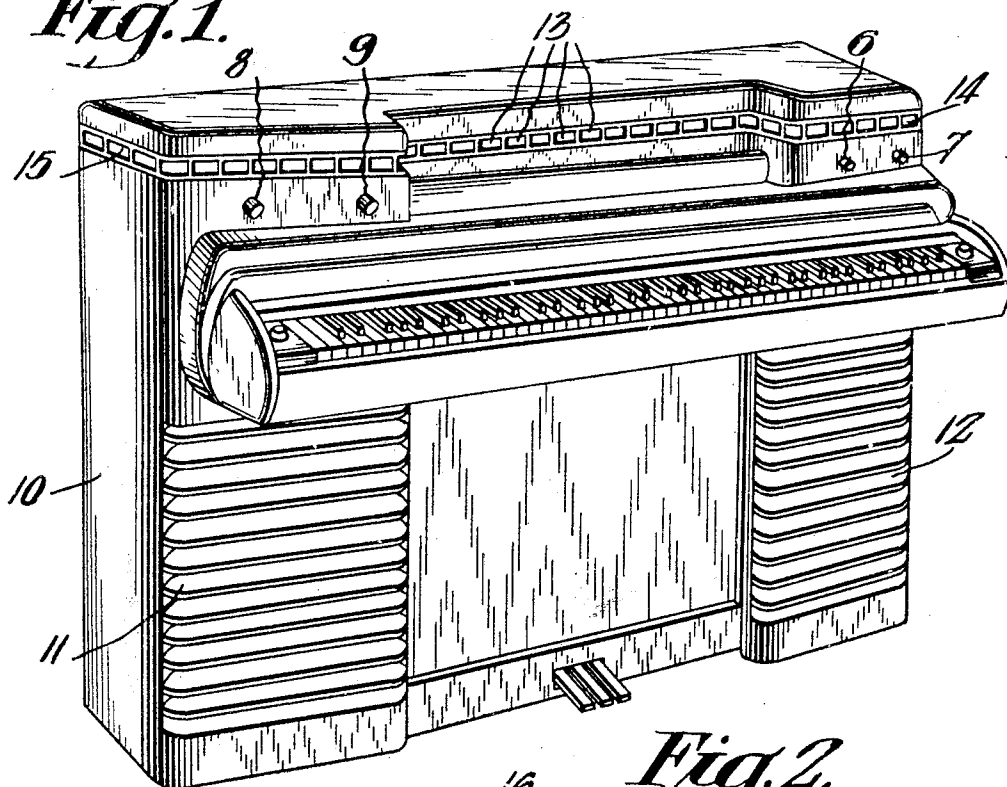


*Fig. 2.*

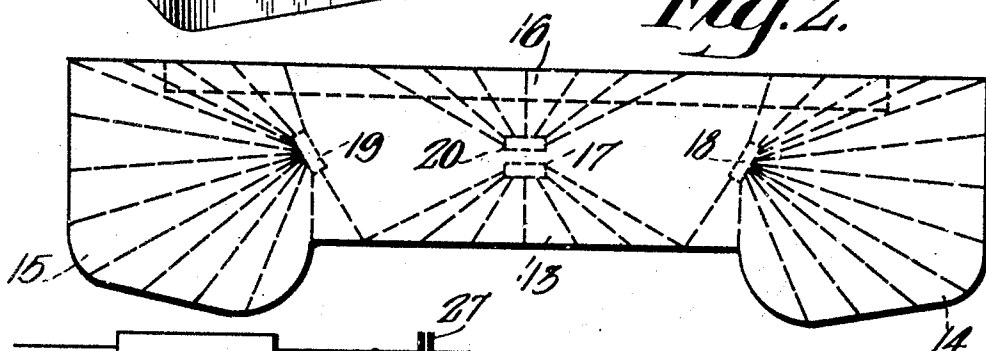
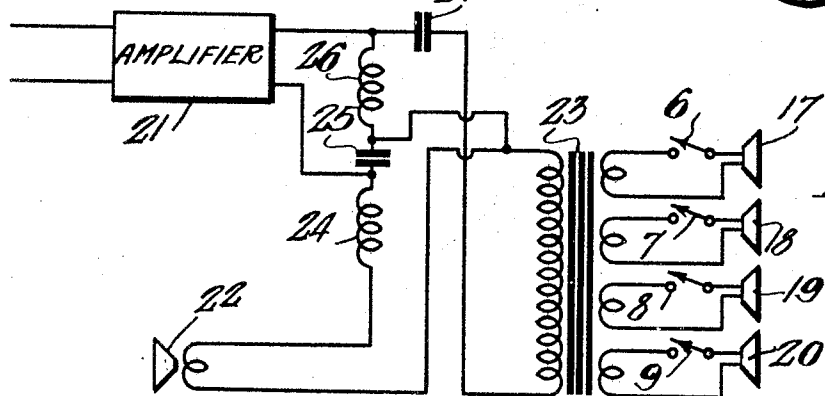


*Fig. 3.*

Inventor

Walter B. LaChicotte Jr.

By

*G. J. Huff*

Attorney

ELECTRIC PIANO

Filed Nov. 30, 1940

2 Sheets-Sheet 2

*Fig. 4.*

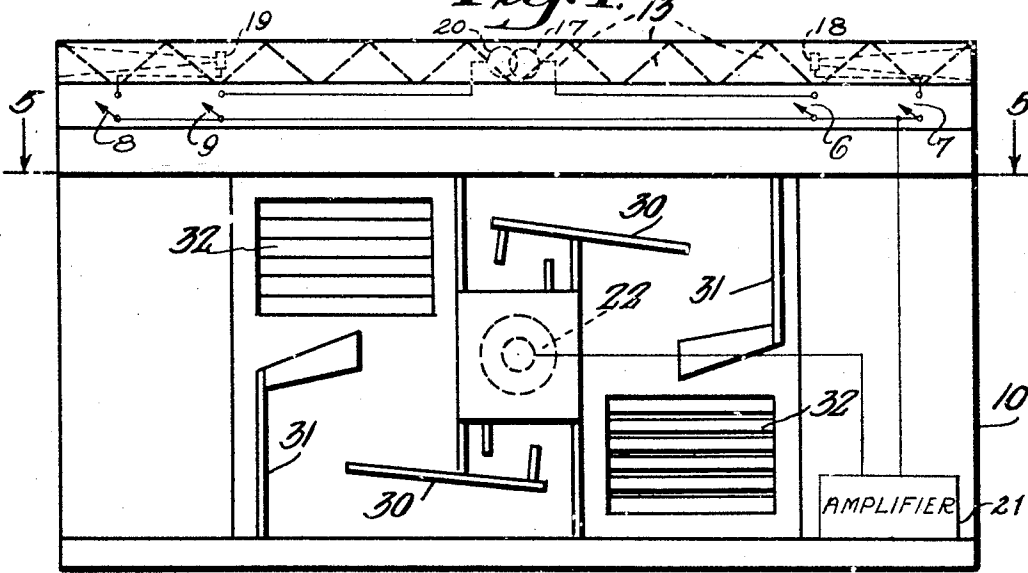


*Fig. 5.*

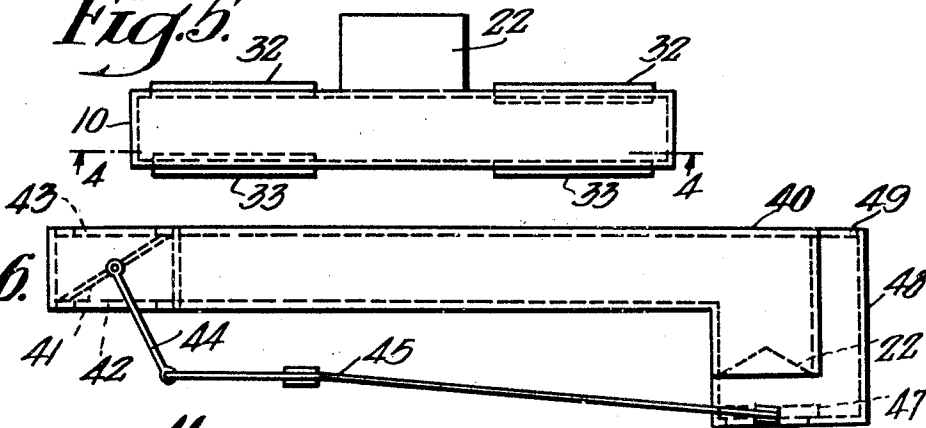


*Fig. 6.*

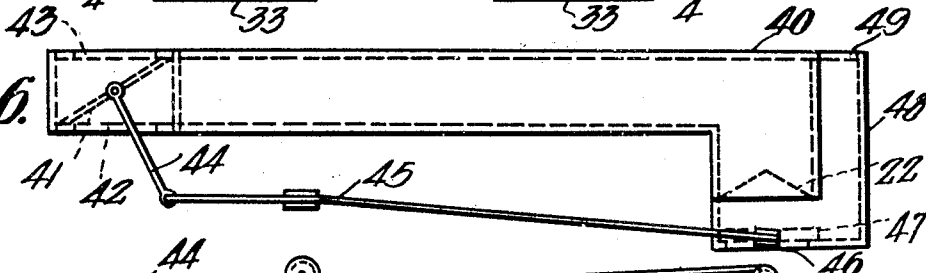
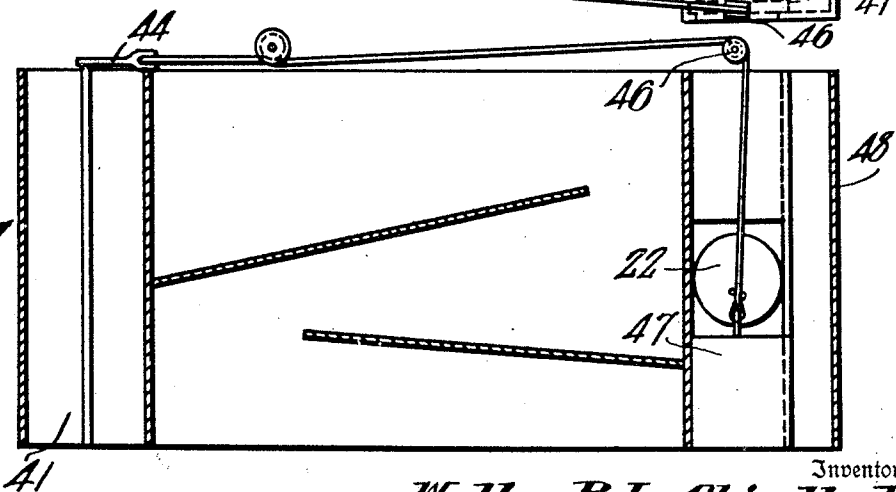


*Fig. 7.*



Inventor  
Walter B. LaChicotte Jr.

By

*J. J. Huff*  
Attorney

## UNITED STATES PATENT OFFICE

2,311,399

## ELECTRIC PIANO

Walter B. La Chicotte, Jr., Haddon Heights,  
N. J., assignor to Radio Corporation of America,  
a corporation of Delaware

Application November 30, 1940, Serial No. 367,873

2 Claims. (Cl. 84—1.01)

This invention relates to electric pianos and more particularly to a sound emission control for electric pianos by which the direction of emission of the sounds therefrom may be controlled at will.

By the term "electric pianos" is meant pianos in which the vibrations are generated by strings and are then electrically picked up and amplified and reproduced through loudspeakers. It will be apparent, however, that the application of this invention is not limited to such devices, but that it may be applied to any equivalent type of electrical musical instrument such as electric organs or other apparatuses in which the tones are mechanically or electrically generated.

In some electric pianos heretofore proposed, the loudspeaker has been directed toward the floor but such an arrangement, of course, produces a great absorption of high frequency and does not produce the impression of the sound coming from different parts of the piano as is normally the case. In a different type of electric piano which has been used commercially the sound is emitted through louvres in the front of the case producing a much more natural effect when the audience is facing the piano from the front or keyboard side. However, due to the fact that such pianos have no sounding board and the back thereof is enclosed by the loudspeaker labyrinth, no sound is directed out of the back and when such pianos are used, for example, on a stage with the back of the piano facing the audience, the effect should be improved by the provision of additional loudspeakers likewise facing the audience.

In the piano of the present invention the deficiencies of the prior art constructions are avoided and a loudspeaker arrangement is provided in which the various sounds of either high or low frequency may be directed at will either out of the back or out of the front of the piano. This is accomplished by providing a number of loudspeakers or loudspeaker passages which may be connected to the amplifier either selectively or collectively and these loudspeakers or loudspeaker passages may control either the high frequencies or the low frequencies, or both.

One object of the invention is to provide an electrical musical instrument in which the high frequency sounds may be directed toward the audience.

Another object of the invention is to provide an electrical musical instrument from which the sounds may be directed in any chosen direction.

Another object of the invention is to provide an apparatus of the class described in which a plurality of high frequency sound reproducers disperse the sound in all directions.

Another object of the invention is to provide an apparatus of the class described in which a cross-over network separates the high frequency and low frequency sounds.

Another object of the invention is to provide an apparatus of the class described in which sounds from a single loudspeaker may be selectively directed in either of a plurality of directions.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawings in which:

Figure 1 is a front view of a piano constructed in accordance with my invention,

Figure 2 is a horizontal section through the high frequency speaker units 14, 15 of Fig. 1,

Figure 3 is a schematic diagram of the speaker connections used in the apparatus of Figs. 1 and 2,

Figure 4 is a vertical section through a modified form of the invention,

Figure 5 is a longitudinal horizontal section through the middle of Fig. 4 on the line 5—5,

Figure 6 is a plan view of a second modification of the invention, and

Figure 7 is a front view partly in section of the form of the invention shown in Fig. 6.

In Fig. 1 the invention is shown as applied to a commercial type of piano known as the "Storytone." In this piano as ordinarily constructed, the speaker is arranged somewhat as shown in Figs. 6 and 7 and the bass notes are transmitted through a speaker labyrinth at the back of the piano, the bass notes being emitted primarily through the louvre 11 and the treble notes being emitted primarily through the louvre 12. In the present commercial construction of this device, the front of the cone 22 shown in Fig. 6 emits the high frequencies. In the construction shown in Fig. 1, the high frequencies are emitted through banks of small speaker horn units indicated at 13, 14, 15 and 16 and the high frequency sounds are delivered thereto by high speaker units 17, 18, 19 and 20, respectively. These speaker units may be of the type designed to reproduce only the higher frequencies at appreciable amplitude and generally referred to in the art as "tweeters." These high frequency speakers are equipped with appropriate switches so that any one or more may be turned on as de-

sired. For example, if the pianist is performing with his back to the audience only the speaker 13 may be used while if the back of the piano is toward the audience only the speaker 16 or 14, 15 and 16 may be used according to the area the sound is intended to cover.

In this form of the invention the circuit arrangement shown in Fig. 3 may be used. In this arrangement the output from the power amplifier 21 is fed through a cross-over network including the inductances 24 and 26 and the capacitors 25 and 27 which transmit the low frequencies to the speaker 22 which cause them to be emitted through the louvres 11 and 12 and the high frequencies are transmitted through the transformer 23 to the speaker units 17, 18, 19 and 20. The cross-over network is of more or less a usual type, the high frequencies being transmitted through the capacitors 25 and 27 to the transformer 23, while the low frequencies are transmitted through the inductors 24 and 26 to the speaker 22. Instead of feeding the speakers directly from the cross-over or frequency-selecting network, the output from a voltage amplifier may be fed into the network, and the output therefrom may be fed to two separate power amplifiers which operate the respective speakers.

The transformer 23 is preferably provided with separate secondaries for each of the high frequency speaker units 17 to 20 in order that the impedances may be readily balanced but any equivalent circuit arrangement may be used. Each of the speaker units is provided with a separate switch 6, 7, 8 and 9 so that the high frequency sounds may be directed in any chosen direction. The low frequency sounds which are not so directional may be emitted through the louvres 11 and 12 as usual or the direction of the emission may be controlled if desired as described hereinafter.

In the form of the invention shown in Figs. 4 and 5, the low frequency sounds from the speaker 22 are directed through a pair of labyrinths formed in the labyrinth chamber by appropriate baffles 30 and 31. After passing through these labyrinths or horns which are designed in the usual manner, the sounds are emitted through the closable shutters 32 or 33 which open into opposite faces of the labyrinth chamber. If the bottom of Fig. 5 be taken as representing the front of the piano then the closing of the shutters 33 and opening of the shutters 32 will direct the low frequency notes out the back of the piano while the closing of the shutters 32 and the opening of the shutters 33 will direct the low frequency sounds out the front of the piano. These shutters may be constructed in any desired manner which will produce the desired sound transmission when open and the necessary suppression of the sound when closed and may be constructed in any of the ways usual, for example, in the construction shutters of a swell organ. If desired, the shutters may be so beveled that in a closed position their edges will fit close to each other and sound tending to be emitted will be absorbed by grooves in the edges of the shutters. Likewise, the shutters may be

made solidly of wood or may be made of sound absorbing composition either solid or composed of a series of layers of sound absorbing and sound impeding material.

In the form of the invention shown in Figs. 6 and 7 the loudspeaker labyrinth is shown in much its present commercial form, but it is provided with a louvre 43 at the back and an opening 42 at the front into the body of the piano. If the valve 41 is in the position shown, the low frequency sounds will be directed through the body of the piano and out through the louvres 11 and 12 as usual. In this case the high frequency sounds may be provided by the high frequency units previously described or the cross-over network of Fig. 3 may be omitted and the high frequency sounds may be emitted from one side of the loudspeaker cone 22 as is now customary. In the latter case it is advisable to provide some means for directing the high frequency sounds out the back of the piano when the low frequency sounds are so directed. I have accordingly provided a shutter 47 which may be pulled up over the opening to the front of the speaker cone 22 when the valve 41 is turned clockwise and in this position the sounds are directed through the passage defined by the partition 48 and pass out through the exit 49 to the rear of the piano while the low frequency sounds pass out in the same general direction through the louvre 43. The valve 41 and the shutter 47 may be connected if desired through the lever 44 and the cord 45 passing over the pulley 46 or these two elements may be independently operated. In this arrangement, as in those above described, the separate high frequency speakers may be used as shown in Figs. 1 to 3 and the high frequency side of the cone may remain covered.

I claim as my invention:

1. In an electric piano, an amplifier, a plurality of high frequency speaker units oriented in different directions and adapted to be selectively electrically connected to said amplifier, a low frequency speaker permanently connected to said amplifier, progressively enlarged sound directing means having an outlet for directing sound therefrom, mechanical means at the outlet of the sound directing means for selectively directing said sound in different directions corresponding to the directions in which it is directed by the high frequency speaker units in operation, and a casing housing all of the aforesaid elements.

2. In an electric piano, an amplifier, a plurality of high frequency speaker units oriented in different directions and adapted to be selectively electrically connected to said amplifier, a low frequency speaker permanently connected to said amplifier, progressively enlarged sound directing means having an outlet for directing sound therefrom, mechanical means at the outlet of the sound directing means for selectively directing said sound in the same direction as it is directed by the high frequency unit in operation, and a casing housing all of the aforesaid elements.

WALTER B. LA CHICOTTE, JR.