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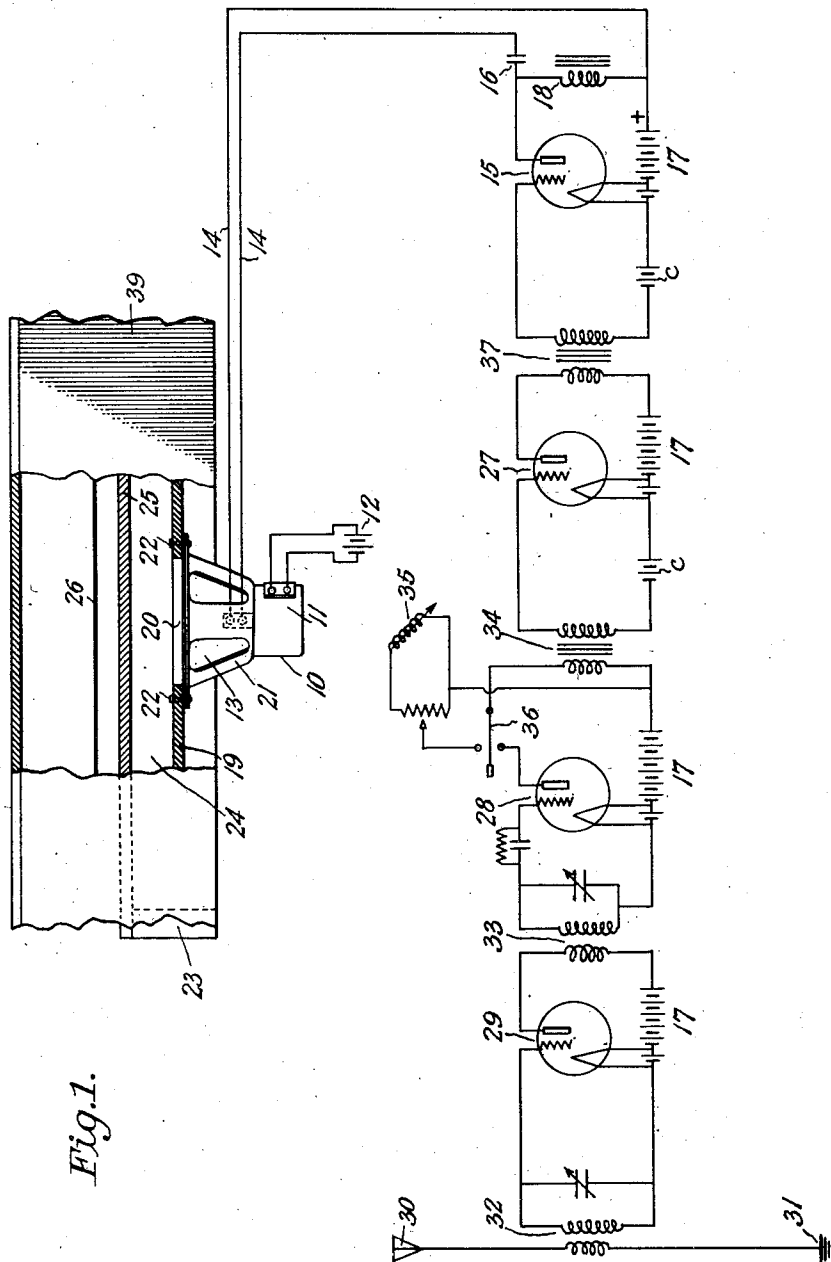
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PIANO MUSIC REPRODUCTION ATTACHMENT

Filed March 16, 1937

2 Sheets-Sheet 1



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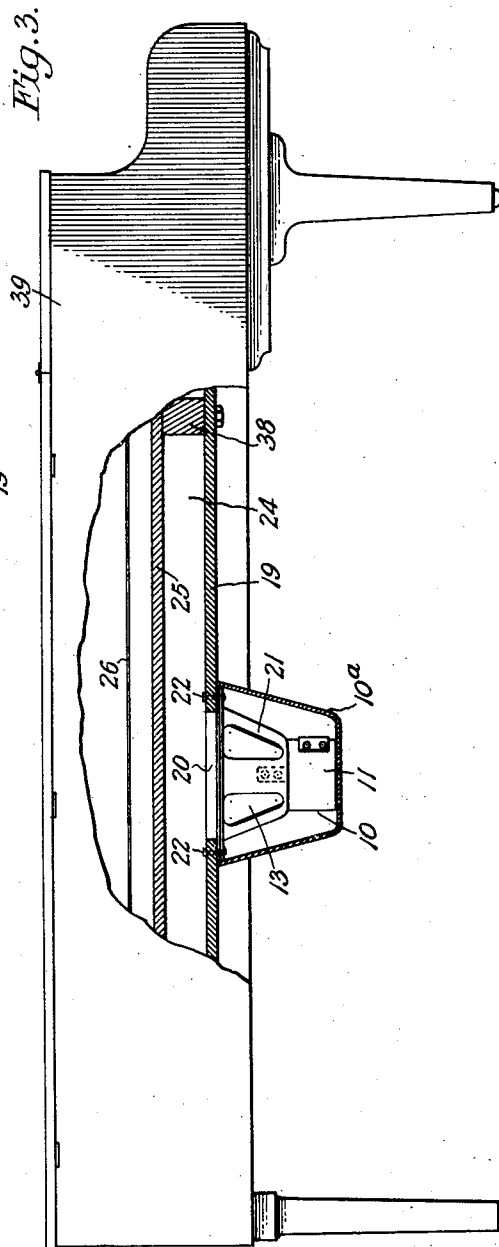
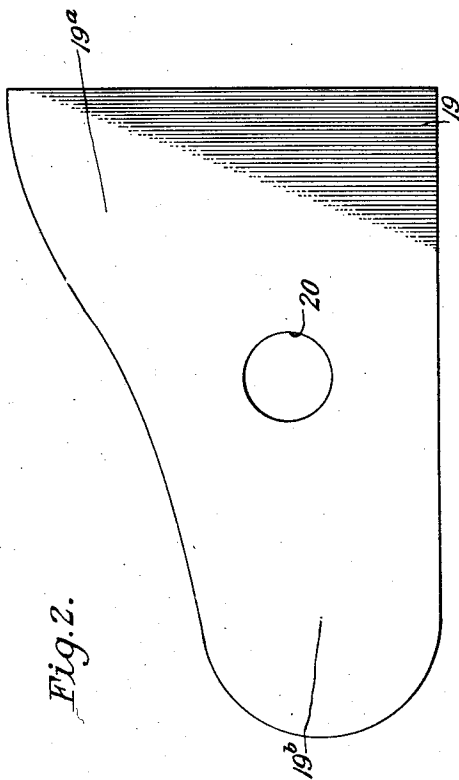
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PIANO MUSIC REPRODUCTION ATTACHMENT

Filed March 16, 1937

2 Sheets-Sheet 2



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2,108,571

PIANO MUSIC-REPRODUCTION ATTACHMENT

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Application March 16, 1937, Serial No. 131,214

6 Claims. (Cl. 84-192)

This invention relates to electrical sound reproducing devices and more particularly to sound reproduction attachments to musical instruments. Specifically it pertains to improvements in means for reproducing radio broadcast or phonographic music applied to a piano.

The principal objects are, first; to provide an attachment device by which the musical sound or performance of a piano may be reproduced with the exactitude of original rendition in the full, true and natural tone quality of that instrument and, second; to provide such a device adapted to afford this result either by radio reception or by phonograph pick-up, and by both selectively according to desire.

Another important object is to provide a device of the character stated that can be produced inexpensively and may therefore be made available to general use at a moderately low cost. Simplicity both in structural component and in attachment or affixture to operative position are further objectives of major consideration.

With the foregoing and other objects in mind as will later appear, the invention proposes the use of a loud speaker in a combined radio reception and phonograph pick-up system applied in particular manner and with a special provision to the sounding board of a piano. I am aware that in a number of instances it has been proposed to combine a conventional loud speaker with the sounding or "sound" board of a piano and that this has been done in various ways. For example, it has been proposed to cut a hole or holes in the piano sound board proper in order to receive the diaphragm of a loud speaker. It has also been proposed to connect the armature of a speaker directly to the sound board by means of a relatively rigid connecting member. All of these prior proposals, insofar as I have been able to learn, have contemplated and the results obtained therefrom have been accomplished by some alteration of or affixture to the sounding board, or by some change in the piano construction, generally requiring an undesirable mutilation and necessarily changing or disturbing the original sound characteristics of the piano with resultant damage thereto.

In the present invention it is not necessary to make any change in the piano or any part of the same. The loud speaker or diaphragm device is attached to a special baffle board instead of the sounding board of the instrument, and the baffle board is affixed inside the frame or cabinet of the instrument below or behind said sounding board in the particular manner which will be more fully described. The sound vibrations emitted by the speaker and magnified by the baffle board are transmitted to the sound board of the piano through an air space or column formed between said baffle and sound boards when the

former is fixed in place. The surrounding walls of the piano frame or cabinet confine this air space or column and aid the sound board effect. They become in effect a part of the baffle board but their plane arrangement renders them alone incapable of serving its purpose, although they might be employed for the speaker mounting with less efficient result. In the case of a grand or concert type of piano, the top closed down might effectually be used as a substitute for the baffle board, but this would require a hole to be made in the top with consequent mutilation and disfigurement of the piano. Actually the best results will be obtained by the use of a baffle board separately applied as will be described presently.

In operation, the sound vibrations from the loud speaker are transmitted to the air column between the baffle and sound boards, which air column is rendered substantially air tight within the chamber formed by these boards and the surrounding piano frame walls, and the sound board is thereby consequently caused to vibrate in synchronism with the vibrations of the speaker diaphragm. These vibrations are in turn communicated by sympathetic response to the strings of the piano which pulsate in harmonious accord with the notes and so impart full tonal quality to the sound being reproduced. It is essential however that the baffle board be not too flexible to vibrate in union with the speaker sufficiently, if at all, to distort the periodicity and sound reproduction. If the speaker and baffle board are properly attached, the sound reproduction through the associated system of the device will have the full richness, depth and pure tone quality of the original piano production. On the other hand, when the baffle board and speaker are detached from the piano, the sound reproduced is relatively hard, flat, and metallic in character.

The invention will be further described in its various details with reference to the attached drawings illustrating one practicable embodiment thereof applied to a grand type piano.

In said drawings:

Fig. 1 is a diagrammatic representation of the invention showing its attachment;

Fig. 2 is a plan view of the baffle board for the loud speaker, drawn to smaller scale; and

Fig. 3 is a broken-away side elevation view of the piano, showing the loud speaker and baffle board attached thereto.

In the illustrative embodiment the improved system or attachment device includes a loud speaker 10, which is preferably of the electrodynamic type, although any desired type, such as the magnetic or piezo-electric type, of speaker may be used. This loud speaker is provided with the conventional field winding housed in a casing 11, the latter being constructed preferably of

magnetic material, such as iron or the like. A source of current supply 12, which may be a battery or a rectified alternating current source, is connected to energize said winding of the speaker. The speaker also has a conventional cone type diaphragm 13 receiving and emitting sound vibrations.

Said diaphragm 13 of the speaker has a movable coil (not shown) positioned in the magnetic circuit of the speaker field and connected through wires 14 to the output circuit of an audio frequency amplifier tube 15. One of said wires 14 is connected to the anode of the tube 15 through a condenser 16 and the other of said wires 14 is connected to the positive terminal of an operating current supply source 17 which may be either a battery, as shown, or an electric light-current conductor line as will be generally preferred. A choke coil 18 is connected between the anode of the tube 15 and the positive terminal of said current supply source 17 to feed an electric current from this source to the anode of said tube.

Said diaphragm 13 is positioned with its large open end adjacent to or against a baffle board 19, in alignment with a hole 20 cut in said board. Preferably, a frame 21 which encircles the diaphragm with a supporting attachment to the aforesaid housing 11 of the speaker is employed for the affixture of the speaker to the baffle board. This affixture is desirably effected by bolts 22 in order to hold the speaker firmly to the board and so prevent any independent and undesirable vibration between the speaker and baffle board. Said baffle board is advantageously constructed of a fibrous or wooden material which does not have a tendency to vibrate at any particular sound frequency and is not readily set into vibration. It should be of a sufficient mass and rigidity as not to vibrate when the loud speaker is energized and caused to reproduce sound frequencies, and to that end it may of course be reinforced or specially constructed.

The baffle board is made to substantially the same size and shape as the sound board and is positioned in the piano frame or cabinet 23, with a snug fitting against the latter's walls, under or behind said sound board depending upon whether the piano is a grand or upright type. In this positioning, to which it is suitably secured by bolt or other fastening, an air column space 24 is provided between the baffle board and the sounding board denoted by 25. This space will perhaps be varied in different instances, but should normally amount to at least 3 or 4 inches. No particular kind or type of sounding board is required because any ordinary sounding board answers the purpose as long as it is supported properly in the piano frame and responds normally to sound frequencies in the audible range. However, the size and shape of the board may necessitate some adjustment of the space provided between it and the baffle board in order to secure perfect results. The ordinary piano strings 26 are of course strung on the opposite side of the sound board from that at which the baffle board is positioned.

The radio receiver and amplifier circuit system connected with the speaker is substantially conventional in its construction. Fig. 1 illustrates this diagrammatically. In addition to the vacuum tube 15 it employs therewith another such tube 27 as audio frequency amplifiers, a third vacuum tube 28 as a detector and a fourth vacuum tube 29 as a radio frequency amplifier, each in its own circuit. However it is entirely feasible

to use any other type of radio receiver circuit, such for instance as the tuned radio frequency or superheterodyne type. In the illustrated circuit the cathodes of the several tubes 15, 27, 28, and 29 are shown to be energized by the "A" batteries of separate battery units 17, while the "B" batteries of the same units apply the potential to the plates, and associated "C" batteries in the individual circuits of tubes 15 and 27 place a bias on the grids. However, it will of course be obvious that some other current source may be employed to operate the circuit, such for instance as the line conductors of a regular lighting circuit as before stated, or by a motor generator or by suitable rectifiers. Likewise, the anode circuits of said tubes 15, 27, 28, and 29 may be energized from one or more battery sources, a line conductor or a motor generator or rectifier circuit.

The tube 29 is coupled to an antenna 30 and a ground 31 through a transformer 32. The output of this tube is coupled through a transformer 33 to the input circuit of the detector tube 28. Similarly, the input circuit of the adjacent audio frequency amplifier tube 27 may be connected through a transformer 34 to the output of said detector tube 28, or, alternatively, to a phonograph reproducer or "pick-up" 35, the alternative connection being effected through and controlled by a switch 36 placed in the output end of said detector tube circuit. Thus the system is adapted to operate for either radio reception or phonograph transmission of sound impulse. Any desired type of electrical phonograph reproducer or electric pick-up may be employed as the unit 35, whether it be of the electromagnetic, the piezo-electric, or some other related type. The output of the audio frequency amplifier tube 27 is connected through a transformer 37 to the input of its corresponding tube 15, while the output of the latter tube is connected to the diaphragm coil of the loud speaker through the wires 14 as previously described. A suitable transformer may desirably be employed in the circuit of the wires 14 in cases where the impedance of the speaker diaphragm coil does not properly match that of the output circuit of said amplifier 15.

Referring again to the loud speaker application to the piano, Fig. 2 illustrates in reduced plan view the aforescribed baffle board 19 through which this is done, and Fig. 3 on larger scale elevationally illustrates said board supporting the speaker fixed in place. The diaphragm hole 20 formed in said board is ordinarily located as nearly as possible in its center. In cases where more than one loud speaker may be used, the holes therefor would be disposed at points having the greatest balanced effect upon the sound board of the piano. For instance, a loud speaker adjusted to reproduce high frequencies might be positioned in the baffle board section 19^a corresponding to the high frequency end of the piano sound board, and a loud speaker adjusted to reproduce low frequencies might be positioned in the baffle board section 19^b corresponding to the low frequency end of said sound board. The baffle board itself is fastened to the frame or to the walls of the piano and not to the piano sounding board. Being of the same size and shape as the sounding board so as to fit in the piano cabinet or case, it forms in effect a false bottom or back to the piano.

The loud speaker 10 mounted on the baffle board may as illustrated in Fig. 3 be advantageously housed within a small cabinet 10^a at-

tached to the bottom of said board, so as to protect it from dust as well as to present a neater appearance. The board is shown abutting and fastened to the bracing timbers 38 of the piano whose casing is denoted by 39. If this board is made strong enough to support a heavy dynamic speaker, no additional support will be needed. Different pianos of course have different systems of bracing so that the manner of the baffle board fastening therein will depend largely upon the members or parts available for the purpose. In all cases however, the sounding board 25 will be above or spaced from the baffle board on the opposite side of the bracing, so as to provide an air column between. This air column transmits the sound vibrations from the one to the other, or, more accurately, from the speaker diaphragm to the sounding board. Should it be found that the air column is resonant to certain sound frequencies because of its uniform width, the baffle board 19 need merely be tilted slightly so as to alter the width of the column from one side to the other, i. e. to give it a gradual depth reduction transverseiy.

The described invention provides for a greatly perfected reproduction of piano music from either radio reception or phonograph pick-up of sound impulses, and both selectively, without in any way interfering with or impairing the capacity of the instrument to be played normally. The sound emitted by the loud speaker is transmitted through the air column to the instrument sounding board and thence pulsationally to its strings, so that the notes are given a full rounded, clear and true tone quality corresponding to that of the original production. So nearly exact and natural is the reproduction that an experienced musician cannot tell the difference between it and the natural play when obscured from sight of the instrument, nor detect any fault in the quality of its tone. In perfecting the reproduction of piano music, the invention also greatly improves the sound reproduction of other instruments and likewise the human voice, either in song or speech, as well as other sound origins. This is believed to be due wholly and directly to the separate baffle board mounting of the loud speaker with the air column space provided between it and the sounding board, and to the absence of any change in or attachment to the latter board. The advantage of attaining reproduction through either radio reception or phonograph pick-up contributes additionally to the enjoyment to be derived from the use of the attachment applicable to any piano.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical sound reproducing device comprising, in combination with a piano, a baffle board secured in the casing of the piano behind the sounding board thereof with a separation from said sounding board providing an air column space between the two boards, a loud speaker secured to the baffle board with its diaphragm directed through an opening therein toward said sounding board, and means for connecting the loud speaker with operating means.

2. An electrical sound reproducing device comprising, in combination with a stringed instrument having a sounding board and a casing surrounding the same, a baffle board secured within the instrument casing behind the sounding board thereof with a spacing between it and

said sounding board providing an air column space between the two boards, a loud speaker secured to the baffle board with its diaphragm directed over an opening therein toward said sounding board, and means for connecting said loud speaker with means for electrically operating the same by radio reception or phonograph pick-up.

3. An electrical sound reproducing device comprising, in combination with a piano having a sounding board supported on a frame within a container casing, a baffle board of substantially the size and shape of the sounding board secured within the casing to the frame of the piano under or behind the sounding board with a separation from said sounding board providing an air column space between the two boards, a loud speaker having a diaphragm secured to the baffle board with its diaphragm directed over an opening therein toward said sounding board, and means for connecting said loud speaker with electrical operating means.

4. In a piano attachment, a baffle board having substantially the size and shape of the sounding board of the piano, a loud speaker including a diaphragm, said loud speaker being mounted on the baffle board with its said diaphragm directed through an opening therein toward said sounding board, and said baffle board with the loud speaker mounting being secured within the casing to the frame of the piano with a spacing from said sounding board thereof providing an air column space between the two boards, and means for connecting said loud speaker with electrical operating means.

5. In a piano attachment, a baffle board having substantially the size and shape of the sounding board of the piano, a loud speaker including a cone-shaped diaphragm and means for connecting said loud speaker to means for electrically operating the same, said loud speaker being mounted on the baffle board with its said diaphragm positioned over an opening therein, and said baffle board with the loud speaker mounted thereon being secured within the casing to the frame of the piano with a spacing from the sounding board thereof providing a closed air column space between the two boards and with the loud speaker diaphragm directed inwardly toward the sounding board so as to emit its sound vibrations thereagainst through the intervening air column.

6. In combination with a piano having a sounding board supported upon a frame and surrounded by an enclosing casing, a loud speaker including a cone-shaped diaphragm, the diaphragm, and a baffle board supporting the loud speaker under or behind the piano with its said diaphragm directed inwardly toward the said sounding board, said baffle board having an opening therein over which the diaphragm of the speaker is positioned with an edge of the latter bearing against the same and being fastened within the casing to the frame of the piano under or behind said sounding board with a spacing from the said board providing an air column space between the two boards, the said air column space serving to transmit sound vibrations from the speaker emitted thereby through said opening in the baffle board directionally toward the sounding board of the instrument, and means for connecting said loud speaker with electrical operating means.

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