

July 29, 1958

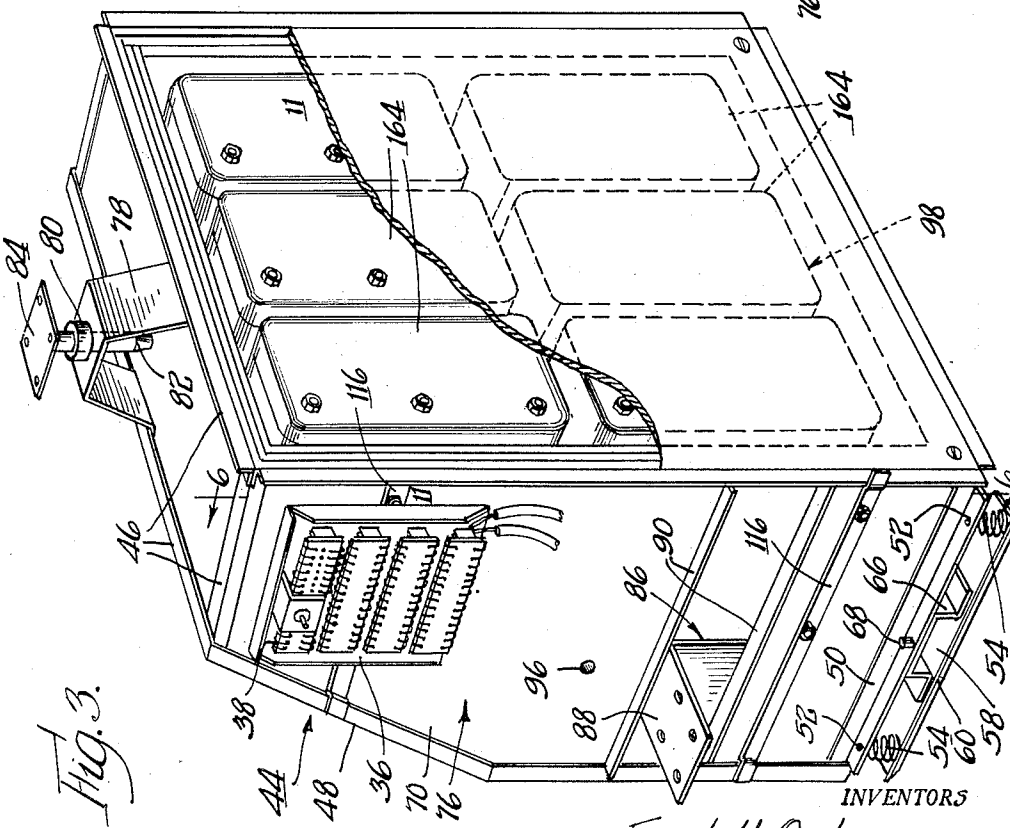
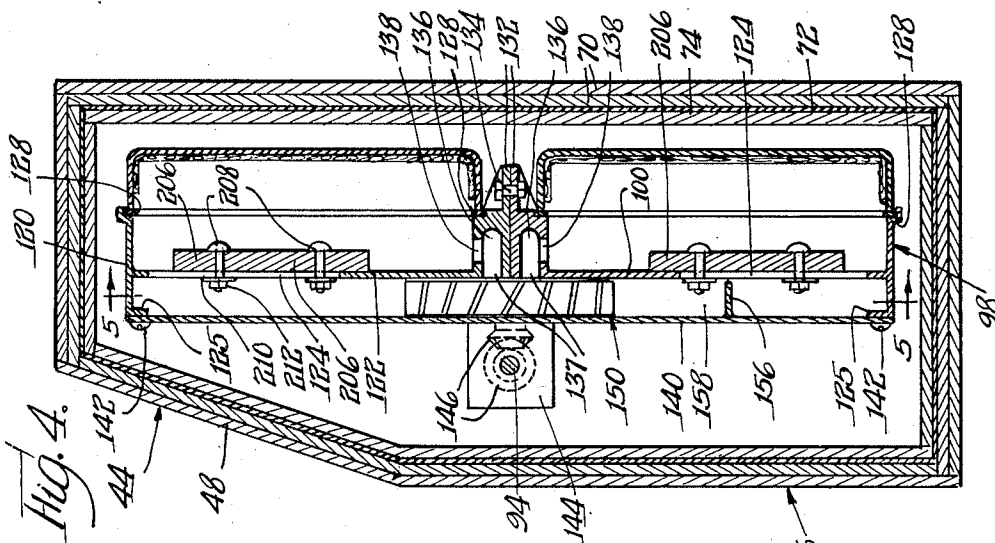
F. H. OSBORNE ET AL

2,844,983

REED BOX FOR ELECTRONIC ORGAN

Filed May 21, 1953

4 Sheets-Sheet 2



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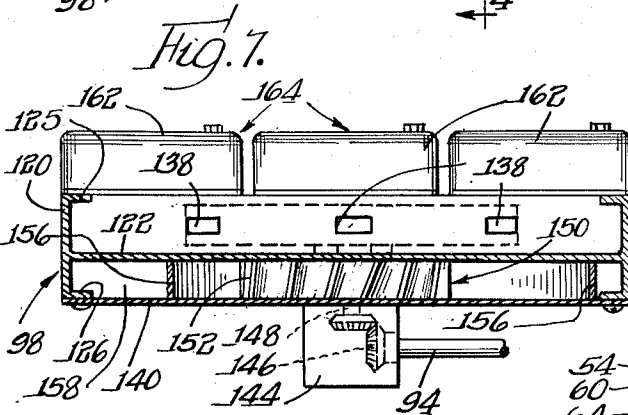
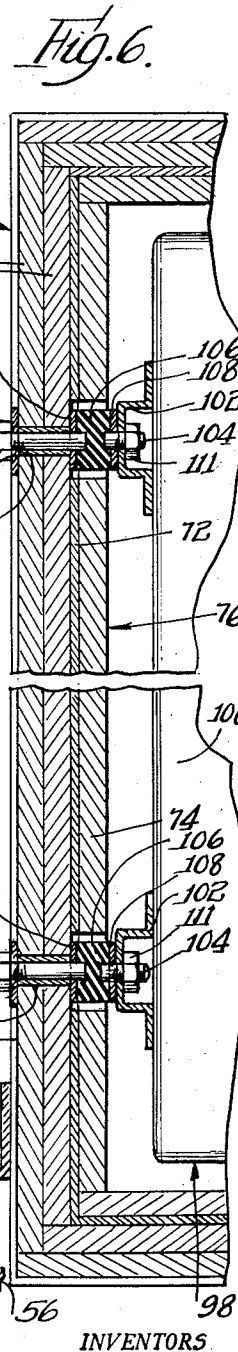
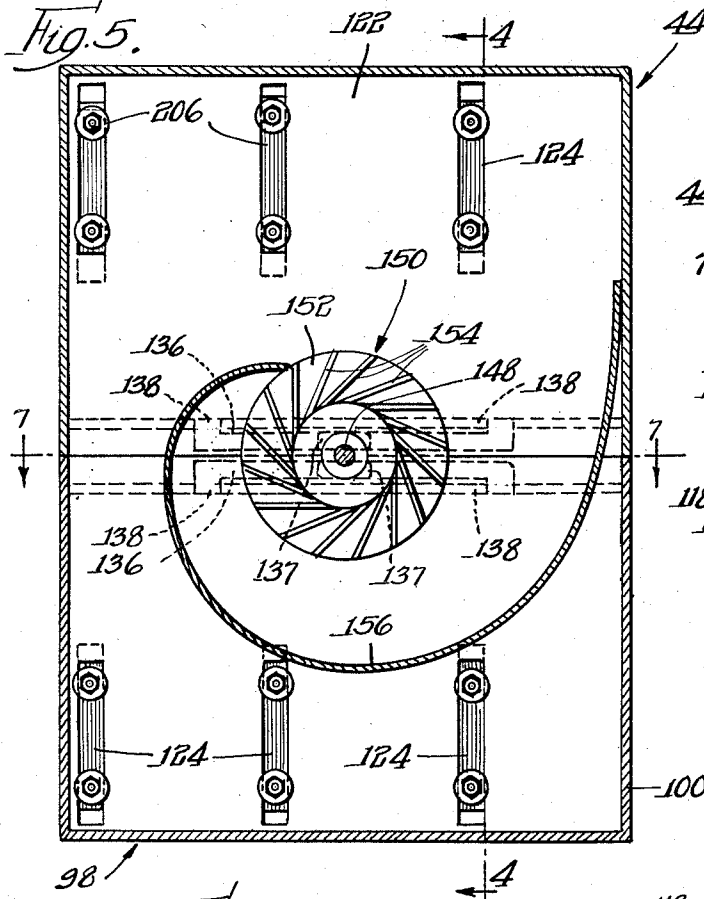
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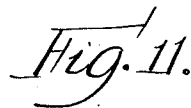


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REED BOX FOR ELECTRONIC ORGAN

4 Sheets-Sheet 4



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2,844,983

REED BOX FOR ELECTRONIC ORGAN

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Application May 21, 1953, Serial No. 356,552

8 Claims. (Cl. 84—1.04)

This invention is concerned with an electronic organ, and more particularly with a reed box therefor.

In many respects the most satisfactory type of electronic organ known today is one in which vibrating reeds are used as the sound generators. In this type of organ, as disclosed in Hoschke Patent No. 2,015,014, each sound is generated by a metallic reed which is used as one plate of a capacitor. The capacitor is such that the capacity varies with vibrations of the reed and the consequent changes in spacing between the reed and a pick-up element, and when a potential is applied across this capacitor, an alternating current potential corresponding to a musical tone is evolved. This alternating current potential is amplified and applied to a transducer, generally a loud speaker, to produce an audible tone. The reeds can be physically deformed or prevoiced to produce any of the sounds of conventional organ stops without the necessity of electronic synthesis and the unpleasant sounds often produced by failure of synthesizing controls or by hurried operation thereof.

The reeds in an organ of this type may be vibrated only when they are to sound, or may be vibrated continuously and electrically energized only when they are to sound. These two different manners of operating the reeds produce different attack and decay characteristics of the sounds produced. This invention is concerned with the type of organ wherein the reeds are vibrated continuously. This type of organ will be referred to herein after as a continuous reed organ.

Certain problems are encountered in vibrating reed electronic organs. Among the most important of these problems is the prevention of audible sounds other than those emanating from the loud speaker. Air noises caused by movement of the air which actuates the reeds must be avoided or stilled. Audible vibrations from the reeds must be stilled. There is a decided tendency for sympathetic vibration of musically adjacent reeds, and musically adjacent reeds tend to produce beat notes which are most unpleasant to the ear. Such interaction must be avoided. A still further problem to be dealt with in vibrating reed electronic organs is the different air requirements of the different reeds. The lower octave reeds are relatively large and require a large volume of air which may be at a low pressure, whereas the higher octave reeds are relatively small and require smaller volumes of air at higher pressures.

It therefore is an object of this invention to provide a new or improved electronic organ obviating the above noted difficulties.

Another object of this invention is to provide, in an electronic organ, a reed box enclosing all of the sound producing agencies and flexibly mounted to prevent transmission of vibrations through frame members.

A further object of this invention is to provide improved sound proofing in an electronic organ reed box.

Another object of this invention is to provide an electronic organ having unit subassemblies which are readily

assembled with and disassembled from the remainder of the organ.

A further object of this invention is to physically isolate musically adjacent reeds.

Yet another object of this invention is to provide adjustable valves to compensate for the varying air requirements of different sizes of reeds.

A still further object of this invention is to provide means for varying the air pressure applied to different sizes of reeds.

Still another object of this invention is to provide an electronic organ having a centrifugal blower for supplying air to the reeds.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings wherein:

Fig. 1 is a side view of an electronic organ embodying the principles of my invention;

Fig. 2 is a rear view of the organ;

Fig. 3 is a perspective view of the reed box on an enlarged scale;

Fig. 4 is a sectional view through the reed box taken substantially along the line 4—4 of Fig. 5;

Fig. 5 is a sectional view through the reed box taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary sectional view taken substantially along the line 6—6 of Fig. 3;

Fig. 7 is a horizontal sectional view through the reed box taken substantially along the line 7—7 of Fig. 5;

Fig. 8 is a vertical sectional view through one of the reed compartments taken substantially along the line 8—8 of Fig. 11;

Fig. 9 is a fragmentary sectional view through one of the reed compartments as taken along the line 9—9 of Fig. 8;

Fig. 10 is a view similar to Fig. 9 showing a different one of the reed compartments;

Fig. 11 is a horizontal sectional view through some of the reed compartments as taken along the line 11—11 of Fig. 3; and

Fig. 12 is a perspective view of one of the reed blocks with some of the reeds mounted thereon.

An organ embodying the principles of the invention herein disclosed is shown in Fig. 1 and is generally designated by the numeral 20. The organ 20 includes a cabinet 22 on which are mounted a pair of manuals 24 and a pedal manual 26 in a more or less conventional manner. The organ also includes stop controls (not shown) mounted in a convenient location for manual manipulation, electronic power supply and amplifier means 28, and a loud speaker 30. A cable 32 leads from a housing 34 at the rear of the manual 24 to a filter circuit board 36. The individual wires of the cable 32 are connected to the individual keys of the manuals 24 and to filters 38 on the filter board 36 in a manner not here pertinent. Another cable 40 leads from the filter board 36 to the electronic power supply and amplifying means 28. Suitable connections (not shown) also are provided from the pedal manual 26 as will be understood. Suitable foot pedals 42 for volume control, etc. are provided as is conventional in electronic organs, and their particular arrangement and connections are not germane to the present invention.

The organ 20 also includes a reed box 44 which may be seen in Figs. 1—6. All of the parts heretofore enumerated are housed within the organ cabinet 22 except for the manuals 24 and 26 and the pedals 42 as will be obvious from Figs. 1 and 2 of the drawings. The rear of the cabinet may be closed for final sound proofing and to keep the parts free from dust, or the back of the cabinet may be left open for heat dissipation from the

electronic power supply and amplifier and from the blower motor to be set forth hereinafter.

The reed box 44 is provided with an exterior metal frame 46 which is welded or otherwise suitably integrated. The reed box is rectangular when viewed from the front or rear, or from above or below, and is rectangular when viewed from either end except for a relieved portion 48.

Angle irons 50 (Figs. 1-3 and 6) comprise lower frame members running from the front to the back of the reed box. Studs 52 extend downwardly from the horizontal flanges of the angle members 50 and serve to locate a pair of coil springs 54 beneath each such horizontal flange. The springs 54 preferably are of frusto-conical configuration to provide greater lateral stability than is possessed by ordinary helical springs. The springs 54 have their lower ends received in cups 56 (Fig. 6) which are welded or otherwise suitably secured to the upper surfaces of a pair of skids 58. Each of the skids 58 is provided with an upturned longitudinal edge 60 and rests on a supporting rail 62 in the form of a flat plate or strip having a longitudinally upturned edge 64. The skids 58 are longitudinally slidable on the rails 62 while the turned-up edges 60 and 64 prevent lateral displacement. A U-shaped bracket 66 is welded or otherwise suitably secured on each of the skids 58 and carries a stud 68 projecting upwardly through an opening in a horizontal flange in the angle member 50 thereabove. These studs and their cooperating opening prevent relative displacement of the reed box 44 and the skids 58 when the reed box is slid in or out of the organ cabinet 22, while the springs 54 support the weight of the reed box and prevent vibrations from being passed from the reed box to the cabinet, thereby tending to eliminate audible noise from the organ.

Sound deadening sheet material is carried by the frame 46 of the reed box 44 and includes two outer sheets or layers 70 of a wood fiber material commercially known as Homasote which are glued or otherwise suitably bonded together. A layer 72 of relatively loose fibrous material made from expanded slag and known commercially as Tufflex is glued or otherwise suitably affixed to the inner of the two wood fiber layers 70. A final layer 74 is glued or otherwise suitably bonded on the inner surface of the layer 72, and the layer 74 is composed of Homasote similarly to the two outer layers.

The sandwich walls 76 made up by the Homasote layers 70 and 74 and the Tufflex layer 72 are substantially sound proof. The Homasote layers possess good sound deadening qualities along with good physical strength. The Tufflex layer is rather loose and has little structural strength, but possesses remarkable sound deadening qualities. The sandwich wall produced as just described is sufficiently strong and rigid, while being substantially impervious to sound.

A sheet metal bracket 78 of substantially U-shape extends across the top of the reed box 44 from the front to the back thereof and is suitably secured thereto as by bolts or by welding. The center of the bracket is apertured and a rubber collar or sleeve 80 is carried in this aperture and receives an elongated stud 82 extending downwardly from a plate 84 which is secured or otherwise suitably affixed to the under side of the top of the organ cabinet. This stud, collar, and bracket hold the reed box 44 against tipping without providing a sound transmitting connection.

A motor bracket 86 having a horizontal platform 88 is suitably carried by a pair of horizontal members 90 on the end of the frame 46. An electric motor 92 is mounted on this bracket and has a shaft 94 extending therefrom through an aperture 96 in the end wall 76 of the reed box. The motor is quiet in operation and, being mounted on the reed box, cannot transmit any mechanical vibrations to the organ cabinet or other parts which might resonate.

The organ is provided with a reed chest 98 (Figs. 2-11) including a die casting 100 (Figs. 4-11). The reed chest is floatingly mounted within the reed box 44 as is illustrated in Fig. 6. The reed chest die casting 98 is provided at its opposite ends with a pair of U-shaped brackets 102, each of which receives a threaded stud 104. The end of each such stud fits into, and is bonded to, a rubber block 106. A metal washer 108 is bonded to the face of each of the blocks adjacent the brackets 102, and the studs further may be secured to the blocks 106 by being welded to these washers or press fitted thereinto, or the washers may be formed integral with the studs. Nuts 111 threaded on the ends of the studs 104 clamp the washers 108 against the brackets 102.

A longer stud 110 projects coaxially with the stud 104 from the opposite end of each rubber block 106. The studs in each block are spaced from one another by part of the block, and the studs 110 are bonded in the blocks similar to the studs 104. Washers 112 on the faces of the blocks opposite the washers 108 are bonded to the blocks and may be formed integral with the studs 110 or may be affixed thereto as by welding or press fitting. A metal spacer 114 encircles each of the studs 110 and spaces the spacers 112 from metal strips 116 which are welded to the ends of the frame 46 as may be seen in Fig. 3 and through which the studs 110 pass. Nuts 118 threaded on the ends of the studs 110 pull the spacers up tight against the strips 116.

The outer two layers 70 of Homasote are apertured to receive the sleeves 116 and to form tight fits therewith, while the Tufflex layer 72 and the inner Homasote layer 74 of each end wall 76 are apertured to provide clearance for the rubber blocks 106 and washers 112. The rubber blocks with the opposed studs bonded thereto provide a floating suspension for the reed chest within the reed box so that mechanical vibrations cannot be passed from the reed chest to the reed box. This floating suspension, combined with the floating suspension of the reed box itself and the sound proof qualities of the reed box walls, prevents any audible sounds from emanating from the reed box.

The reed box die casting 100 is formed in two sections and when bolted together is provided with a continuous, substantially rectangular peripheral wall 120. The die casting is provided with an intermediate wall 122 (Figs. 4-11) having six spaced apart, elongated apertures 124. The peripheral wall 120 is provided with inwardly directed flanges 125 and 126 at its opposite edges and the intermediate wall is provided with shoulders 128 on a center portion 130.

The central portions 130 are provided with contacting flanges 132 having bolts 134 passing therethrough to bolt the two die casting sections together. The center portions 130 are cored or formed with openings to provide manifolds 136 opening through the plate or intermediate wall 122 substantially centrally thereof as at 137. Three lateral openings 138 pass up and down respectively through the manifold walls from the manifold chambers 136.

A cover plate 140 (Figs. 4, 7, and 11) closes the front end of the die casting 100 and is secured thereto by means such as screws 142 passed through the cover plate 140 and threaded into the flange 124. A gear box 144 (Figs. 4 and 7) is mounted on the outside of this plate centrally thereof and receives the drive shaft 94, or an extension thereof, of the motor 92. The gear box contains suitable gears, such as the bevel gears 146 illustrated, for driving a shaft 148 extending through the cover plate 140 at right angles to the shaft 94 to drive a centrifugal blower 150.

The centrifugal blower 150 includes a rotary impeller 152 having a plurality of blades 154. The impeller is hollow at the center for receiving air from the openings 137 of the manifolds 136 and is secured by any suitable means such as a spider to the shaft 148 for rotation there-

with. A spirally curved plate is fixed to the inner surface of the cover plate 140 to form a scroll 156 cooperable with the impeller 152 centrifugally to force air outwardly into the space between the peripheral wall 120, the intermediate wall 122, and the cover plate 140, this space forming an air chamber 158.

In addition to the parts heretofore set forth, the die casting 100 is provided with relatively thick vertical walls 160 extending at right angles from the intermediate wall 122 and coacting with the peripheral wall 120 and the central portion 130 to demarcate six areas over which dished out lids 162 are secured to form octave boxes 164. Each of the elongated openings 124 in the intermediate wall 122 opens into one of the octave boxes 164 and is partitioned from the remainder of the box by a relatively thin wall 166 extending from end to end of the box in parallelism with the relatively thick walls 160. The walls 166 are formed integral with the die casting 100 and extend out from the intermediate wall 122 the same distance as the relatively thick walls 160. The relatively thin walls 166 are provided with inwardly directed flanges 168, while the relatively thick walls are provided with inwardly directed flanges 170.

One octave of reeds for the organ is mounted within each octave box 164 by means of three reed blocks 172, each of which supports four reeds and which are spaced apart to prevent the transmission of mechanical vibrations from one block to another. Each block as readily may be seen in Fig. 12 is formed of Bakelite or some other suitable insulating material and comprises a flat plate or base 174. Raised portions 176 detachably hold reed frames 178 on the block 172. The reed frames carry vibratory reeds 180, and the block is provided with elongated openings 182 beneath each reed for the passage of air. The block is provided with four apertures 184 near the corners thereof through which screws 186 (Figs. 8 and 11) are passed and threaded into the flanges 126 and 168 to mount the blocks.

The blocks 172 are mounted so that they are spaced from one another to prevent vibrations from being transmitted from one block to another. The reeds are further isolated by having no musically adjacent reeds spaced adjacent one another. The reeds which are physically adjacent one another are musically sufficiently different that there is no tendency for sympathetic vibration which would cause a reed to beat off its natural frequency, and there is no production of beats.

Pick-ups are provided for cooperation with the reeds and comprise screws 188 (Figs. 8 and 11) threaded through insulating support members 190 held a suitable distance from the reeds by screws and spacer sleeves (not shown). The screws are locked in place by jam nuts 192. Additional pick-ups are provided in the form of metallic leaves 194 mounted on a raised insulating portion 196 of the reed block 172. The specific details of these pick-ups and their connections, as well as the details of the reed blocks, do not form a part of the subject matter of this invention and therefore need not be set forth in any greater detail.

The lids 162 are sound proofed by a coating of Tufflex 198 (Fig. 11) secured to the inner surfaces of the lids with any suitable adhesive and sprayed with latex. The lids are held in place as shown in Fig. 11 by studs 200 threaded into the intermediate wall 122 and projecting outwardly through openings 202 (Fig. 12) in the reed blocks and through suitable openings in the lids. Nuts 204 are threaded on the outer ends of the studs 200 removably to retain the lids in place.

As heretofore noted, each of the octave boxes 164 contains reeds corresponding to a different octave of the organ. As also noted earlier, the lower octave reeds require a larger volume of air at a lower pressure than do the higher octave reeds. To compensate for this, adjustable valves are provided. Air from the centrifugal blower enters the octave boxes from the compartment

158 through the openings 124 in the intermediate wall 122. Wooden blocks 206 (Figs. 4, 5, 8 and 11) partially close off these openings and are held in place by screws 208 passing through the blocks 206 and through the openings 124. Large washers 210 span the openings 124 and receive the screws 208. Nuts 212 threaded on the ends of the screws 208 clamp the washers 210 and blocks 206 against the intermediate wall 122 to hold the blocks in position. The position of the blocks, and hence the amount of air admitted to each octave box, is adjustable by loosening the screws 208 and sliding the blocks 206 to a desired position, the screws thereafter again being tightened.

The manner in which the volume of air is controlled and also in which the pressure is controlled is shown in Figs. 9 and 10. In Fig. 9 there is illustrated a high octave box identified by the numeral 164a, and in Fig. 10, there is illustrated a low octave box indicated by the numeral 164b. The numerals used in Figs. 9 and 10 are the same as those heretofore used, except that the suffix *a* is added to the parts of the high octave box illustrated in Fig. 9, while the suffix *b* is added to the parts of the low octave box shown in Fig. 10, these suffixes being added for purposes of differentiation.

In the high octave box 164a shown in Fig. 9, the wood block 206a is positioned rather high in the opening 124a so that only a relatively small inlet 214a is afforded. This allows a relatively small volume of air to enter the high octave box 164a from the chamber 158. The reed blocks 172a are spaced from one another a slight distance to leave small spaces 216a between them. Some of the air entering the high octave box by-passes the reeds 180a and openings 182a and passes through the spaces 216a. This by-passing tends to prevent fluctuations in air pressure in the octave box which otherwise might be set up in the vibrating reeds, and hence prevents air coupling of the reeds. Air coupling of the reeds would have the same effect as mechanical coupling through reed mounts, i. e. mechanically adjacent reeds would tend to "pull in" toward one another and thus beat off their natural frequencies, and beat notes would be produced. Although the spaces 216a are sufficiently large to tend to effect pressure equalization and to prevent air coupling, they are sufficiently small to maintain a relatively high pressure in the octave box 164a.

In the low octave box 164b shown in Fig. 10, the wood block 206b is adjusted to a lower position so as to leave a greater portion of the aperture 124b uncovered, thereby providing a larger inlet 214b to allow a larger volume of air to enter the octave box 164b. The reed blocks 172b are spaced farther apart to provide larger spaces 216b between them, thereby to by-pass a larger volume of air around the reeds and their corresponding openings. The larger by-pass spaces reduce the air pressure within the low octave box and in combination with the larger inlet opening provide for a larger volume of air at a lower pressure to pass the reeds. It will be understood that in the interest of manufacturing uniform parts, the reed blocks in all of the octave boxes can be uniformly spaced. The spaces between the reed blocks then are filled or calked to a greater or lesser degree depending upon the amount of by-pass desired.

It will be seen that the objects of this invention are attained by the structure hereinbefore set forth. The organ has unit assembly characteristics in that each octave of sound producing instrumentalities is isolated from every other octave, and the various subassemblies consisting of the reed blocks and also of the individual reeds and frames are readily inserted and removed. The mounting of the reeds on a plurality of blocks in each octave prevents mechanical coupling or interaction of the reeds, particularly in view of the physical spacing or mixing up of musically adjacent reeds. Air coupling of the reeds is prevented by the isolation of individual

octaves and by the spaces between reed blocks in each octave which tend to produce pressure equalization.

The flexible mounting of the reed box in the organ cabinet, and the flexible mounting of the reed chest within the reed box prevents mechanical transmission of audible sounds from the reeds, while the "sandwich" of Homasote and Tufflex used for the walls of the reed box operates as an extraordinarily efficient sound deadener further to prevent transmission of audible sounds from the reeds through the air or through any of the parts of the organ.

The adjustability of the wood blocks to vary the size of the inlet openings into the octave boxes allows greater or lesser amounts of air to be supplied properly to operate the reeds according to their size and consequent air volume requirements. The variable size of the spaces between the reed blocks providing air by-passes compensates for the different air pressures required by reeds of different sizes.

The centrifugal blower used for supplying air to the reeds is well adapted to distribute air around the physical layout of the various reeds. Furthermore, a centrifugal blower provides a substantially constant delivery of pressure regardless of the amount of air used. This is of importance when considering that adjustment of the wood blocks may vary the air requirements of an individual organ. It is obviously undesirable to have any critical air supply means that could be upset by varying the volume of air required.

It is to be borne in mind that this invention is concerned with a continuous reed organ, i. e. one in which all of the reeds vibrate at all times the organ is in use. The problems of such electronic organs are unique and are solved as set forth in this specification and summarized just above.

It is to be understood that the specific structure shown and described is set forth by way of example, and that various modifications are possible without departing from the spirit and scope of the invention. Invention therefore is to be understood as incorporating all that falls within the purview of the claims appended hereto.

The invention is hereby claimed as follows:

1. An electric organ comprising an organ cabinet; a wind chest in said cabinet, said wind chest comprising an intermediate wall, a peripheral wall encompassing said intermediate wall and substantially perpendicular thereto, an end wall on said peripheral wall substantially parallel to said intermediate wall and spaced therefrom, said end wall, said intermediate wall, and said peripheral wall defining an air chamber, a centrifugal air impeller in said chamber mounted for rotation about an axis substantially perpendicular to said intermediate wall and extending axially substantially from said intermediate wall to said end wall, said impeller being mounted substantially centrally of said intermediate wall, said intermediate wall having a plurality of air apertures there-through generally symmetrically disposed about said impeller, reed supporting means carried by said intermediate wall and said peripheral wall and spaced in part from said intermediate wall in the opposite direction from said end wall and substantially parallel to said intermediate wall, said reed supporting means, said intermediate wall, and said peripheral wall defining a plurality of air return channels to said impeller, and cover means on said peripheral wall and said reed supporting means defining therewith a plurality of inlet channels from said air apertures to said reed supporting means; a plurality of vibratory reeds in said wind chest disposed in groups respectively between said inlet channels and said return channels and continuously vibrated by air moved by said impeller; means for converting the oscillations of said reeds into electrical oscillations; and means for changing the electrical oscillations into audible organ tones.

2. An electric organ as set forth in claim 1 and further

including a wall disposed between said intermediate wall and said end wall and spiraling outwardly from said impeller for guiding air from said impeller to said air apertures.

3. An electric organ as set forth in claim 1 wherein the cover means comprises a plurality of dished covers concave toward said intermediate wall and extending convexly outwardly beyond said peripheral wall in a direction away from said intermediate wall.

4. An electric organ as set forth in claim 3 wherein there is a group of reeds within the confines of each cover, each group encompassing an octave of reeds corresponding to successive musical tones.

5. An electric organ as set forth in claim 3 wherein each air aperture is elongated, said apertures and said covers being equal in number, further including a narrow passageway from each elongated air aperture opening into the inlet channel associated with the corresponding cover, and a plurality of slide blocks respectively mounted in said narrow channels and of substantially the same width as said narrow channels, said slide blocks constituting valve means adjustable to compensate for the different air requirements of the different groups of reeds.

6. An electric organ as set forth in claim 5 wherein reed supporting means comprises a plurality of blocks each supporting a plurality of reeds forming a submultiple of a corresponding group of reeds, said reed blocks being spaced apart to provide air bypass spaces.

7. An electric organ as set forth in claim 1 and further including a substantially sealed, acoustically insulated sound box containing said wind chest and a motor within said sound box and driving said air impeller.

8. An electric organ as set forth in claim 6 wherein the sound box is comprised of self-supporting laminated walls including inner and outer layers of relatively soft, self-supporting wood-fiber board material and an intermediate layer of expanded slag material.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,844,983

July 29, 1958

Fred H. Osborne et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 69, for "linet" read --inlet--; column 8, line 33, for the claim reference numeral "6" read --7--.

Signed and sealed this 14th day of October 1958.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE
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