July 21, 1959 R. F. SCHNEEBERGER ET AL 2,895,366

ORGAN STRUCTURE AND FILTER PANEL

Filed June 18, 1953 3 Sheets-Sheet 1

Fig. 1.

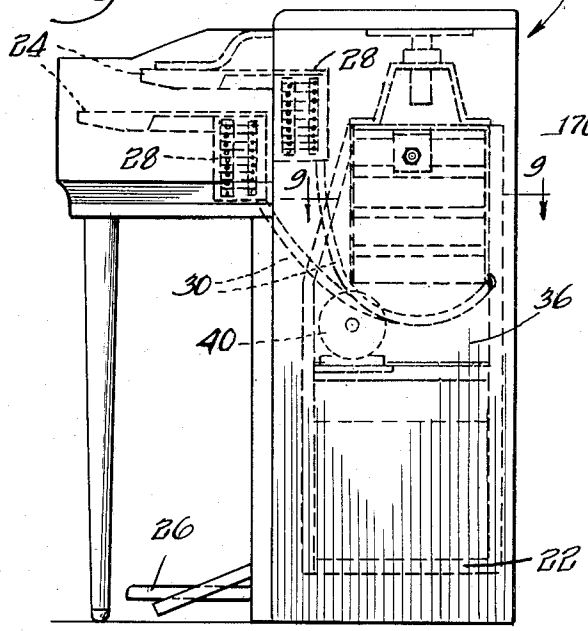


Fig. 3.

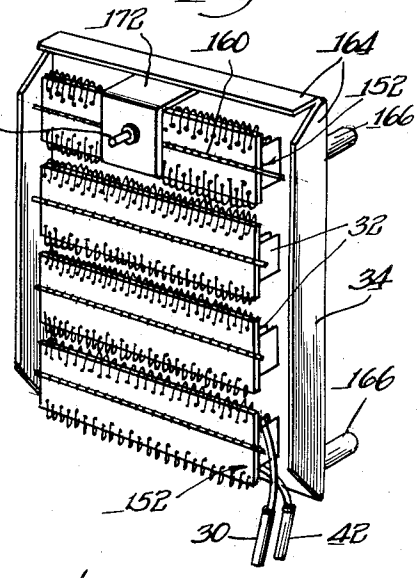
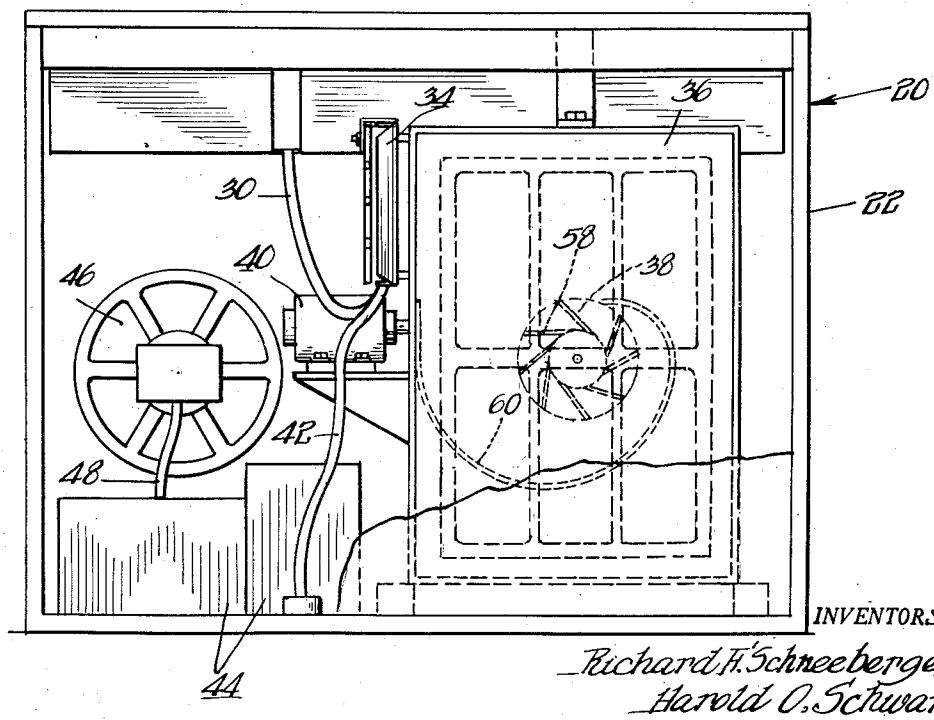


Fig. 2.



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3 Sheets-Sheet 2

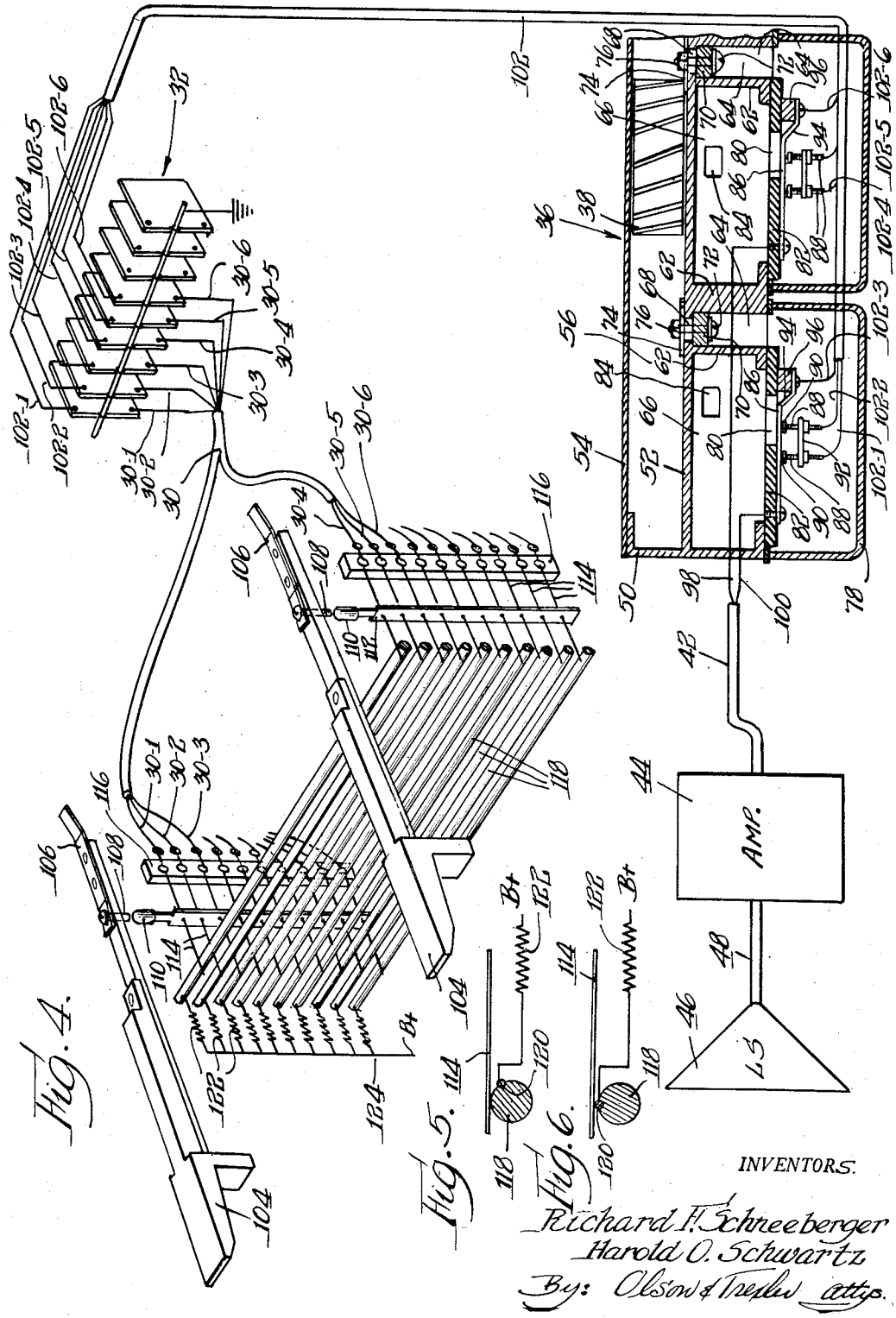

Fig. 4.

Fig. 5.

Fig. 6.

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3 Sheets-Sheet 3

Fig. 7.

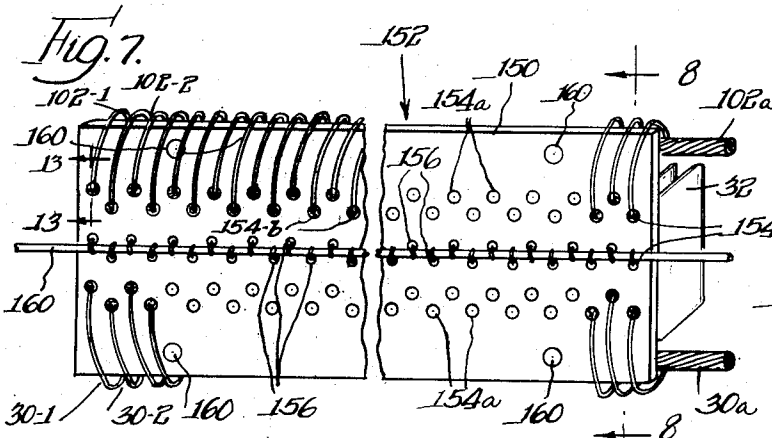


Fig. 8.

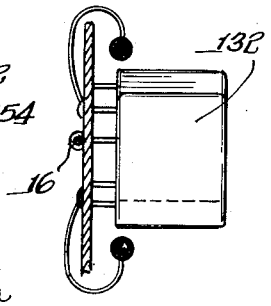


Fig. 9.

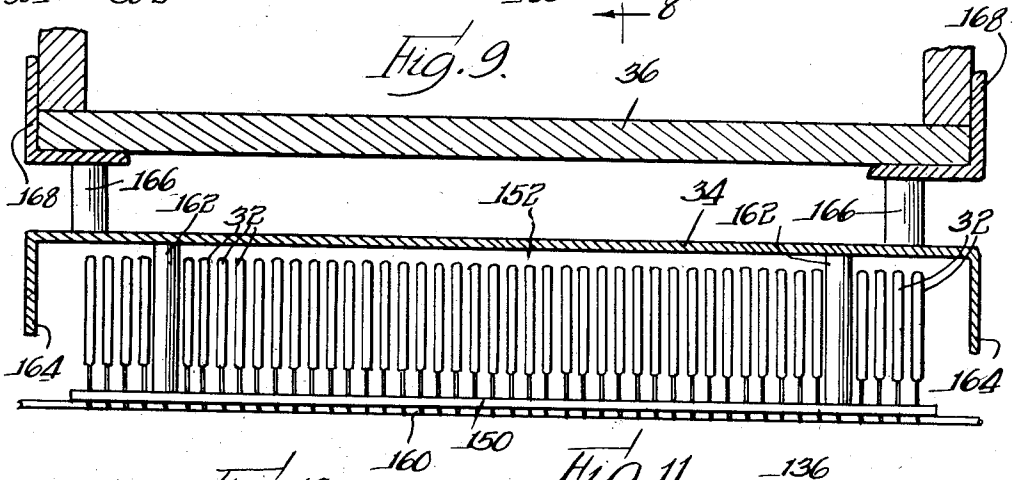


Fig. 10.

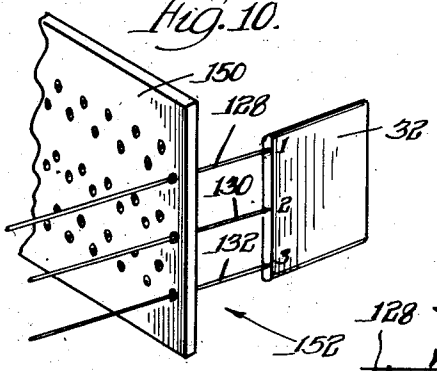


Fig. 11.

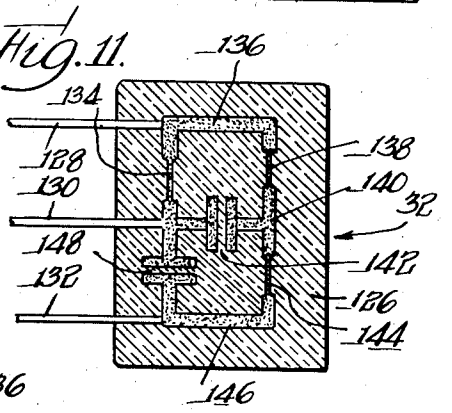


Fig. 13.

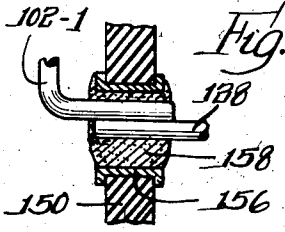
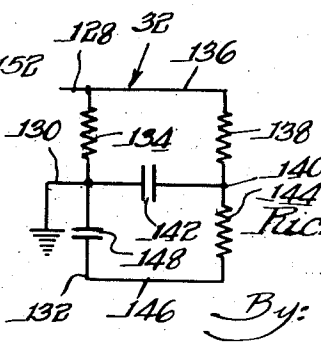


Fig. 12.



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2,895,366

ORGAN STRUCTURE AND FILTER PANEL

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Application June 18, 1953, Serial No. 362,593

4 Claims. (Cl. 84—1)

This invention is concerned generally with an electronic organ, and more specifically with an electronic organ of the continuously operable reed generator type and the physical arrangement of the components, and particularly the arrangement of a plurality of filters and a mounting panel therefor.

Electronic organs use various types of sound generators. Generally, the most satisfactory type of sound generator is a wind driven vibrating reed. In an organ using reeds as generators, there is generally provided a metallic reed corresponding to each note, and each reed is spaced from one or more cooperable pickup elements. Each reed and pickup element forms a capacitor, the capacity of which varies with the spacing between the reed and pickup element as the reed vibrates; when a D.C. potential is impressed between each reed and its associated pickup element or elements, i.e. across the plates of each capacitor, one or more A.C. potentials are established in accordance with the vibrations of each reed. By suitably twisting and bending the reeds they can be made to vibrate in specific modes giving rise to notes very closely resembling those of the various stops of a pipe organ, e.g. flute, viola, diapason, et cetera. Lifelike organ tones thus can be reproduced without the necessity of combining and shaping circuits.

The reeds of vibrating reed electronic organs can be vibrated individually as the notes are to be sounded, or they can be vibrated continuously and caused to sound by applying potentials as required. This invention is concerned with an organ of the latter type, hereinafter referred to as a continuous reed organ.

Certain problems are encountered in organs of the continuous reed type. Key clicks must be eliminated and the sound volume of each note played must be controlled in attack and decay to avoid percussive effects. It has been found that key clicks can be avoided and that attack and decay can be controlled satisfactorily by suitable filter circuits. However, for best results, a filter is necessary for each tone generated. An exorbitant physical space for filters thus is necessary according to conventional practices and production costs are high.

An object of this invention is to provide a novel filter mounting arrangement.

Another object of this invention is to mount the filters of a continuous reed electronic organ in banks.

More specifically, it is an object of this invention to mount all of the filters of a continuous reed electronic organ on a single panel occupying a small space.

A further object of this invention is to provide subassemblies of filters for a continuous reed electronic organ.

It is an object of this invention to position banks of filters adjacent the associated key switches of a continuous reed electronic organ.

Another object of this invention is to space filter banks both from associated key switches and from associated amplifying means in a continuous reed electronic organ.

Yet another object of this invention is to provide a unit construction for a continuous reed electronic organ.

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

Fig. 1 is an end view of a continuous reed electronic organ embodying the principles of the invention disclosed herein, certain parts being broken away for clarity of illustration;

Fig. 2 is a rear view of the organ;

Fig. 3 is a perspective view of the filter panel and a plurality of banks of filters thereon;

Fig. 4 is a view partly in perspective, partly in section, and partly diagrammatic in nature showing the operating parts of the invention herein disclosed;

Fig. 5 is a cross sectional view showing the engagement of a key switch when the associated stop is closed;

Fig. 6 is a view similar to Fig. 5 with the associated stop in open position;

Fig. 7 is a perspective view of one of the filter banks taken from the bottom thereof;

Fig. 8 is a cross sectional view of the filter bank as taken along the line **8—8** of Fig. 7;

Fig. 9 is a longitudinal sectional view of filter panel as taken along the line **9—9** of Fig. 1;

Fig. 10 is an exploded perspective view showing the assembly of a filter with its associated supporting base;

Fig. 11 is a view of one of the filters partly broken away and showing the physical arrangement thereof;

Fig. 12 is a schematic wiring diagram electrically illustrating the filter of Fig. 11; and

Fig. 13 is a cross sectional view along the line **13—13** of Fig. 7 showing a soldered connection of one of the filters and the corresponding wire of the connecting cable.

Referring first to Figs. 1 and 2 for a general understanding of the invention disclosed herein, there will be seen an electronic organ **20** comprising a cabinet **22** having a pair of manual keyboards **24** and a pedal keyboard **26**. Appropriate key switches **28** are associated with the various keys **24** and are connected by means of cables **30** to the filters **32** mounted on a filter panel **34**. The filter panel **34** is mounted on the side of a reed box **36** containing a plurality of vibratory reeds, a wind chest and a blower or impeller **38**. A motor **40** also is mounted on the side of the reed box for driving the blower or impeller **38**.

A cable **42** connects the reeds to electronic amplifying and power supply means **44**. The electronic amplifying means are connected in turn to a loud speaker **46** by a cable **48**.

As may be seen in Fig. 4, the reed box **36** includes a peripheral wall **50**, an intermediate wall **52**, and a rear wall or cover **54**. These three walls cooperate to define a wind chest or chamber **56** in which is mounted the blower or impeller **38**. The blower or impeller **38** is of the centrifugal type having a plurality of blades **58** (Fig. 2) receiving air at the center and discharging it substantially radially outwardly in cooperation with a scroll **60** mounted between the intermediate and rear walls **52** and **54**.

The intermediate wall **52** is provided with a plurality of right angularly disposed walls **62** cooperating with one another and with the peripheral wall **50** to provide a plurality of air inlet passages or conduits **64** and air outlet chambers **66**. Elongated apertures **68** are provided in the intermediate wall **52** for passing air into the passageways or conduits **64**. The apertures **68** are partially closed off by elongated blocks **70** held in place by bolts **72** passing through the blocks and through large wash-

ers 74 on the opposite side of the intermediate wall and threaded into nuts 76. The blocks 70 can be adjusted by loosening and tightening the bolts 72 to control the amount of air passing from the chamber or chest 56 into the passageways or conduits 64 in accordance with the individual air volume and pressure requirements.

A plurality of dished-out covers 78 is provided and one such cover is secured over each cooperating inlet passageway 64 and outlet chamber 66 to direct air from the inlet passageway to the outlet chamber through openings 80 in reed blocks 82. Air passes from the outlet chambers 66 through channels 84 to the center of the blower 38 for recirculation.

Each reed block 82 carries a plurality of vibratory reeds 86 which are vibrated by the air passing past them. A pair of pickup elements 88 having heads 90 cooperable with each reed 86 is threaded through an insulated mounting plate 92 for adjustable juxtaposition to the corresponding reed. An additional pickup 94 cooperable with the end of each reed 86 is supported by an insulating block 96. The reeds are twisted and bent to cause them to vibrate in predetermined modes corresponding to the stops of a pipe organ. Due to the twisting and bending each reed vibrates differently along its length and the several pickups cooperable therewith produce the tones of different organ stops from a single reed.

There are twelve reeds associated with each inlet passageway 64 and outlet chamber 66 corresponding to the musical tones of an octave. Each octave obviously is isolated from every other octave to provide interaction among the reeds, and the reeds in each octave preferably are mixed up in such a manner that musically adjacent reeds are physically spaced apart to prevent interaction.

The reeds are connected to the amplifier 44 through the cable 42, two of the wires from the reeds to the cable being indicated at 98 and 100 in Fig. 4. The pickups 88 and 94 are individually connected to the filters 32 through the wires of a cable 102, six of these wires being indicated as 102–1 through 102–6. The attachment of the wires of the cable 102 to the filters will be understood better after a description of the filters themselves and their connections to the key switches.

Referring again to Fig. 4, there are shown two keys 104 from either of the keyboards 24. The keys are mounted in horizontal position by means of spring metal members 106 which are secured to a fixed part (not shown) of the organ. Each key is provided with an adjustable actuator in the form of a screw 108 threaded through the key and adjustable up and down by screwing it in and out. Each of the actuators 108 is engageable with a rubber bumper 110 on the upper end of an insulating strip 112. Each insulating strip is provided with a row of vertical apertures receiving a series of hard nichrome wires 114 projecting from an insulating base 116 suitable mounted on a fixed part of the organ (not shown).

The wires 114 project transversely across the upper edges of a series of horizontal rods 118 of bakelite or other suitable insulating material. These rods, as best may be seen in Figs. 5 and 6, are provided with axially extending conductive inserts 120 of suitable conducting material such as relatively soft nichrome wire. All of the conductive inserts 120 are connected through suitable resistors 122 to a B+ bus or supply line 124.

The rods 118 are mounted for rotation through substantially 90° and are under the control of suitable stop switches (not shown). When a stop switch is in closed position, the associated rod 118 is rotated so that the conductive insert 120 lies to one side of the rod as illustrated in Fig. 5. When a stop switch is opened, the associated rod 118 is rotated to bring the conductive insert 120 to the top of the rod as shown in Fig. 6 where it is in position for engagement with an associated one of the wires 114.

The wires 114 normally are spaced above the rods 118 and inserts 120. When a key 104 is depressed, the actuator 108 engages the rubber bumper 110 to force down the associated insulating strip 112. This causes the wires 114 to flex to bring them into contact with the insulating rods 118 or conductive inserts 120, depending on the positions of the associated stop switches as illustrated in Figs. 5 and 6. In each instance when a stop switch is in open position and a key is depressed, potential is applied from the B+ bus 124 through the appropriate resistor 122 and conductive insert 120 to the proper wire 114. Each wire 114 is connected through one of the lead wires of one of the cables 30 to the filters 32, six such wires being illustrated at 30–1 through 30–6.

Each of the filters 32 is of the printed circuit type and takes the form of a flat wafer. The physical structure of one such filter is shown in Fig. 11 with the corresponding electrical diagram being shown in Fig. 12. Each filter 32 comprises an insulating base or plate 126 of ceramic or other suitable material. Three lead wires or terminals 128, 130 and 132 are connected to each filter, and specifically to conductors formed on the insulating base 126 by means of carbon or metallic particles. The conductors of the filter are formed by relatively wide deposits of metal or carbon granules, the resistors are formed by restricted paths of such granules, and the capacitors are formed by spaced apart areas of such metal or carbon granules, all as is well known in the art of printed circuits. The first lead or terminal 128 is connected to a resistor 134 which is directly connected to the center lead or terminal 130. The first terminal also is connected by a conductor 136 to a resistor 138, the opposite end of which is connected to a junction point 140. The junction point 140 is connected through a capacitor 142 to the central terminal 130 and also to a resistor 144. The other end of the resistor 144 is connected through a conductor 146 to the third lead or terminal 132. A capacitor 148 is connected between the central terminal 130 and the third terminal 132.

As shown in Figs. 7–10, a plurality of the filters 132 is mounted on a relatively long and narrow insulating base or strip 150 to form a bank 152 of filters. There are four such banks in all as readily may be seen in Fig. 3. Each strip 150 is formed of laminated fibrous material or of other suitable insulating material and is provided with a plurality of sets of apertures 154. There are three apertures in each set, and alternate sets are offset from one another as illustrated at 154A and 154B. The outer two of each set of apertures 154 are provided with metal eyelets or bushings 156 as best may be seen in Fig. 13. The first and third terminals of a series of filters 32 are placed through these eyelets and are secured in position by drops of solder 158. The central terminal 130 of each filter passes through the central aperture 154 of each set, the central apertures not being provided with eyelets or bushings. A ground wire 160 (Figs. 7, 8 and 9) extends along the longitudinal center line of the strip 150 on the side opposite the filters 132, and the central terminals or leads 130 are wrapped over this wire and soldered thereto. The offsetting of alternate sets of apertures 154 places alternate central apertures on opposite sides of the median line, and alternate central terminals 130 are folded over the ground wire 160 from opposite sides thereof. These terminals thus help to centralize the ground wire and to hold it in place before soldering. An additional advantage of the offsetting of alternate sets of apertures 154 is that adjacent sets can be placed more closely together without the eyelets 156 or associated drops of solder 158 contacting one another.

After the terminals 128 and 132 have been soldered in the eyelets 156, and the central terminals 130 have been soldered to the ground wire 160, the ends of the leads or terminals are clipped off. Each of the strips

150 is provided with a plurality of apertures 160, four for example, adjacent its edges for receiving posts 162 by means of which the strips 150 are mounted on the panel 34 with the filters 32 extending toward the panel. As is illustrated in Fig. 3, four banks of filters are mounted on the panel 34 in this manner, although it is contemplated that a greater or lesser number could be so mounted. The panel 34 is in the form of a metal sheet having its four edges bent at right angles to form flanges 164 which shield the filters both electrically and mechanically. The panel 34 is mounted by means of posts 166 from the frame 168 of the reed box 36.

The cables 30 and 102 are divided into sub-cables lying along the opposite edges of the strips 150. Two of these sub-cables are illustrated at 30*a* and 102*a* in Fig. 7. These sub-cables are located on the same side of each strip as the filters 32, and the wires thereof are looped over the edges of the strip and inserted in the drops of solder 158 as may be seen in Figs. 7 and 13. The ground wires 160 all are connected to a single ground connection 170 held by a bracket 172 on the panel 34.

As will be obvious, the potential applied to the wires 114 through the resistors 122 and inserts 120 when a key is depressed with a stop open is applied to the input terminal of each filter 32, there being one filter for each reed pickup element 88, 94. The potential, properly filtered to prevent key clicks and to control attack and decay is impressed through the proper wire of the cable 102 on a predetermined one of the pickup elements 88, 94. The alternating current potential generated by the associated vibrating reed then is applied through the proper wire, such as 98 or 100, of the cable 42 to the amplifier 44. The amplified oscillation then is transformed by the loud speaker 46 into an audible organ tone corresponding to the key depressed and the stop switch open.

It will be seen that the mounting of the filters in banks as herein disclosed requires a minimum of space for the filters. The mounting of the filters in banks allows them first to be fabricated as sub-assemblies, thus materially facilitating manufacture and lowering manufacturing cost. The filters are located near the key switches so that unduly long lead wires are not required, and the filters are spaced both from the key switches and from the amplifier so as to be readily accessible. The general overall physical arrangement of the organ as shown and described is such that the various components can be fabricated as sub-assemblies, or units, thus speeding manufacture and lowering cost.

The specific example of the invention herein set forth is by way of example only, and it will be understood that various changes can be made in the particular structure shown and described without departing from the spirit and scope of the invention as expressed in the following claims.

The invention is hereby claimed as follows:

1. In an electronic organ, the combination comprising a plurality of vibratile reeds and cooperable pickups, means positioned adjacent said reeds and acting thereon for continuously vibrating said reeds, a source of electrical potential, a plurality of key switches individually connecting said reeds and pickups to said source of electrical potential, a plurality of keys for operating said switches, a filter panel, a plurality of banks of filters mounted on said panel, each filter comprising a unit, and a bank of filters comprising a common base on which a plurality of such units are mounted, a plurality of said bases being mounted on said panel, each such base being elongated and having the filters mounted transversely thereof and parallel to one another, said bases being flat and mounted parallel to said panel and spaced therefrom substantially in a common plane, said plurality of bases being substantially parallel and coterminous, means individually connecting said reeds and pickups to the filters of said banks to eliminate key clicks and to control attack and decay, amplifier means, means connecting said reeds and cooperable pickups to said amplifier means for amplifying electrical oscillations generated by said reeds, and a loud speaker for converting the amplified electrical oscillations into audible organ tones.

2. In an electronic organ, the combination as set forth in claim 1 wherein each filter base is provided with three sets of holes extending longitudinally of the base, one set being adjacent the longitudinal centerline of each base and the other two sets respectively being adjacent the lateral edges thereof, each of said filters having three leads respectively extending through the holes of a set, and a common ground wire extending along each base in the vicinity of the longitudinal centerline and on the side of the base opposite the filters, the center lead of each filter being connected to said ground wire.

3. In an electronic organ, the combination as set forth in claim 2 wherein the reeds, pickups, and vibrating means are mounted as a unit, the keys and key switches are located remotely thereof, the filter panel is mounted adjacent said key switches but separated therefrom, and the amplifier means is mounted remote relative to the foregoing parts, and wherein the various connecting means comprise a plurality of cables, a pair of cables lying along the lateral edges of each base and having a plurality of wires respectively connected to the leads of said filters extending through the holes adjacent said lateral edges.

4. In an electronic organ, the combination as set forth in claim 1 wherein the filters are mounted between their respective bases and the panel, and wherein the panel is provided with edge flanges projecting in the direction of said bases and shielding said filters.

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