Aug. 12, 1958 C. L. WOLGAST 2,846,914

GATE CIRCUIT FOR ELECTRIC ORGAN

Filed June 30, 1953

Fig. 1.

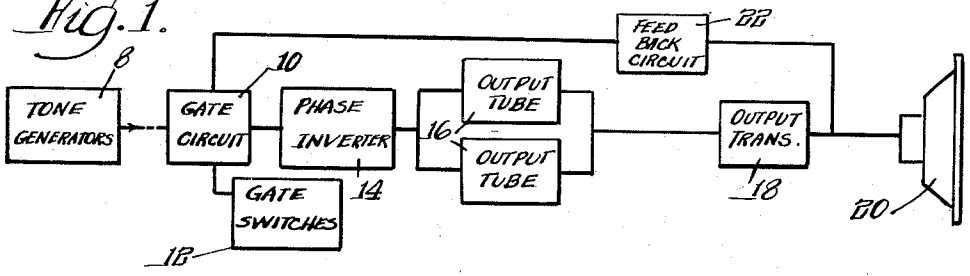


Fig. 2.

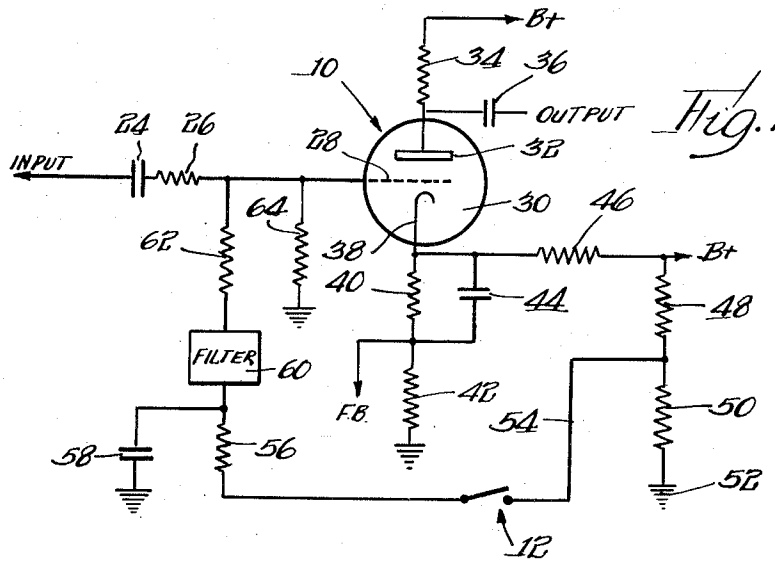
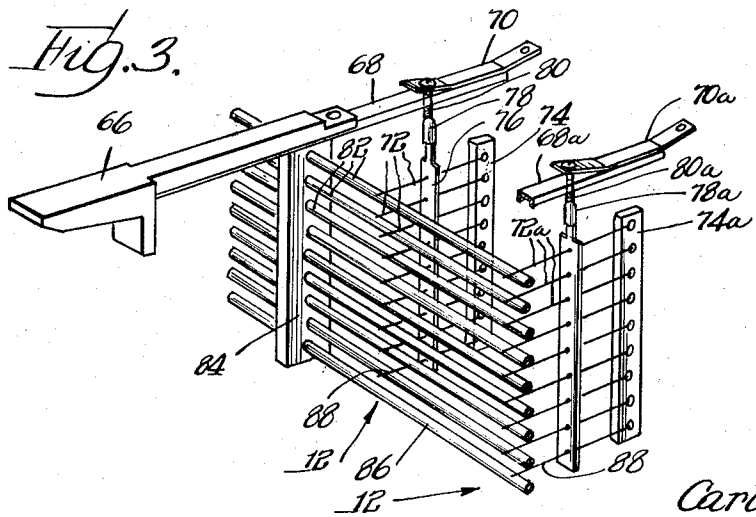


Fig. 3.



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United States Patent Office 2,846,914
Patented Aug. 12, 1958

2,846,914

GATE CIRCUIT FOR ELECTRIC ORGAN

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Application June 30, 1953, Serial No. 365,183

4 Claims. (Cl. 84—1.04)

This invention is concerned generally with an electronic organ, and more particularly with a gate circuit for controlling the amplification of an organ amplifier according to whether or not a musical note is generated.

Most electronic amplifiers tend to pick up some hum in the early stages of the amplifier. This hum is amplified by succeeding stages and may be of significant magnitude at the output stage. More specifically, in an electronic organ of the electrostatic type, the generator voltages are low and high amplification consequently is necessary, thus boosting the hum in the output to a high level. This problem is particularly acute in an electronic organ of the continuous reed type.

The use of a vibratile metallic reed and an associated pickup element as a variable capacitor to generate electrical oscillations resembling organ tones is well known in the art. A reed generator of this type is disclosed in Hoschke Patent No. 2,015,016. Generation of the notes can be controlled by applying a potential continuously across each reed and its associated pickup, and by blowing air past a reed to cause it to vibrate when it is desired to play the corresponding note. Generation also can be controlled by continuously blowing air past all of the reeds in an organ to vibrate the reeds continuously, and by applying potential across a reed and associated pickup when it is desired to play the corresponding note. The latter type of generation control has certain advantages in that there is no time lag due to inertia of the reed which slows starting and stopping, and in that a more economical organ can be fabricated. This type of organ is known as a continuous reed organ.

When air is blown continuously past a vibratile reed and associated pickup, the friction of the moving air develops a static charge between the reed and pickup. Thus, even when no potential is applied across a reed and pickup, there is a tendency to generate a note. This tendency appears as a number of relatively low volume spurious notes in the output of the organ translated into audible sound by a loudspeaker in the organ. When one or more organ notes are being played, they are of sufficiently higher volume than the spurious notes to mask or cover the spurious notes so that the latter are not heard at all. However, when no note is being played the combination of all of the spurious notes and of hum picked up in earlier stages of the amplifier produces a most annoying audible hum from the organ loudspeaker.

The general object of this invention is to correct the situation outlined above.

Another object of this invention is to provide, in an electronic organ, means for reducing the gain of an amplifier when no notes are being played to reduce or eliminate hum from the output.

More specifically, it is an object of this invention to provide electronic organ amplifier means wherein the gain is reduced, but the amplifier means is not cut off completely when notes are not being played, thereby reducing or eliminating hum in the output without introducing any clicks.

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

Fig. 1 is a block diagram of a portion of an electronic organ circuit embodying the principles of the invention;

Fig. 2 is a schematic wiring diagram of the gate circuit or volume reducing stage; and

Fig. 3 is a perspective view illustrating the keying of the gate circuit.

Referring now in greater particularity to the figures wherein like numerals are used to identify similar parts throughout, there will be seen in Fig. 1 a plurality of continuously operable reeds acting as organ tone generators indicated generally at **8** and connected to a gate circuit **10** through a suitable preamplifier stage or stages (not shown). The amplification of the gate circuit is determined by a plurality of parallel connected gate switches indicated generally at **12**. The output from the gate circuit **10** is applied to a phase inverter **14** or other push-pull driving device such as a transformer. The phase inverter **14** in turn drives a pair of push-pull connected output tubes **16** which are conventionally connected to an output transformer **18**, the output of the transformer being translated into audible sound by a speaker **20**. A feed-back circuit **22** preferably is connected from the output transformer back to the gate circuit for improved linearity and further elimination of hum.

The gate circuit **10** is illustrated more fully in Fig. 2, wherein the input may be seen to be connected through a capacitor **24** in series with a resistor **26** to the control grid or element **28** of an electron tube **30** or an equivalent electronic valve. The tube **30** is provided with a plate **32** which is connected through a load resistor **34** to a B+ source. The output from the gate circuit **10** is provided by means of a capacitor **36** connected to the plate **32**.

The tube **30** is provided with a cathode **38** which is grounded through series connected resistors **40** and **42**, the former of which may be by-passed by a capacitor **44**. The feed-back circuit **22** is connected to the junction between the resistors **40** and **42** as indicated by the arrow at FB. The cathode further is connected through a resistor **46** to a B+ source, this latter B+ source being grounded through a voltage divider comprising series connected resistors **48** and **50**, the latter being grounded as at **52**.

The junction between the resistors **48** and **50** is connected by wires **54** to the gate switches **12** indicated in Fig. 2. The gate switches **12** are connected through a resistor **56** to a filter **60**, and this filter is in turn connected through a resistor **62** to the grid **28**, a grid resistor **64** being provided according to conventional electronic circuity. The junction between the resistor **56** and filter **60** is connected to ground through a capacitor **58**.

The values of the circuit elements are chosen so that with the gate switches **12** open, the gain of the gate circuit stage is one. When one or more of the gate circuit switches **12** are closed, potential is applied through the wires **54**, the switches **12**, resistor **56**, filter **60** and resistor **62** to vary the bias upon the grid of the tube **30** and thereby to raise the amplification factor to ten. By reducing the amplification factor to one, rather than by cutting off the tube **30** completely, clicks caused by opening and closing of the switches **12** are avoided. The filter **60** is of any suitable construction to cause the amplification factor to build up and decay similarly to the build up and decay of musical notes generated by the organ. This insures that all portions of the musical notes will be passed without having the amplification unnecessarily high to pass portions of the hum or spurious notes gen-

erated. The filter **58** also keeps the amplification from dropping rapidly at the end of a note in order that successive notes when played in rapid sequence all will be amplified identically without any build up or decay of the grid bias at the tube **30** and consequently bias at the tube **30** and consequently of the amplification of the gate circuit **10**.

One key **66** of an organ keyboard is shown in Fig. 3. This key may be of any suitable construction and is flexibly mounted by means of a metallic bar **68** and a leaf spring **70** on a fixed support (not shown). A plurality of flexible wires **72** is mounted on a fixed insulating member **74** beneath the key **66** and bar **68**. The wires **72** pass through suitable apertures in an insulating strip **76** which is mounted by suitable means (not shown) for vertical reciprocation. A bumper or abutment member **78** on top of the strip **76** is engageable by an actuating member **80** carried by the bar **68** to deflect the wires **72** downwardly when the key **66** is depressed.

It will be understood that there is a plurality of keys similar to the key **66** and that there are a set of flexible wires and associated parts for each key, the keys being laterally spaced in a conventional keyboard. This arrangement is illustrated in part by a key bar **68***a* and mounting spring **70***a*, a set of flexible wires **72***a* mounted on an insulating support **74***a*, and a bumper **78***a* engageable by an actuator **80***a*.

A plurality of insulating rods **82** made of suitable material such as "Bakelite" is mounted in suitable supports such as the support **84**. The rods are mounted transversely of the keys and there is one rod for each wire of a set of wires **72**. The wires **72** are adapted to engage the rods **82** when the wires are deflected downwardly. All of the rods except for the bottom one are rotatably mounted and carry longitudinally extending conductive inserts, the rods being rotatable by suitable stop controls selectively to position each insulating rod or its conductive insert for engagement by corresponding wires of the several sets. Thus, whenever a key is depressed a potential is applied to whichever of the wires **72** engages a conductive insert in a rod **82**, thereby to energize tone generating reeds according to the note played and according to the stop chosen.

The bottom rod, identified by the numeral **86**, either may be a conductive member or may be insulating and carry a conductive member permanently positioned for engagement by all of the lower wires, specifically identified by the numeral **88**. The rod **86** and wires **88** form the gate switches **12**. It will be understood that the rod **86** and wires **88** are repeated for each keyboard in the organ, and that all of the rods **86** are electrically connected in parallel and all of the wires **88** are electrically connected in parallel.

Accordingly, whenever any key is depressed to play a note, one of the gate switches **12** is closed to change the bias on the grid of the tube **30** and thereby to raise the amplification from one to ten to amplify the musical note. The unitary amplification with the organ in idle condition, but turned on, prevents hum and spurious notes from being amplified to a point where they are audible in the output of the organ. The unitary amplification, as opposed to complete cutting off of the gate circuit, avoids key clicks that otherwise would be present whenever one of the gate switches **12** was opened or closed.

The specific example herein shown and described is illustrative only and is not to be construed as a limitation on the invention. Various changes in structure can be made and form a part of the invention in so far as they fall within the spirit and scope of the appended claims.

The invention is hereby claimed as follows:

1. In a continuous reed electronic organ, the gate circuit comprising an electronic tube having plate, grid, and cathode elements, an input circuit connected to the grid and cathode elements of said tube, a plurality of continuously vibrating wind driven organ tone generator reeds tending to accumulate static charges, a plurality of organ keys individually manually movable from idle to playing position operatively to connect said tone generators selectively to said input circuit, a source of B+ voltage, a voltage divider connected to said source of B+ voltage and to said cathode element normally to limit amplification of said tube to a low value with all of said keys in idle position, and means including voltage divider means for applying B+ voltage to said grid element when a key is moved to playing position to raise the bias of said grid element relative to said cathode element to effect substantially higher amplification of said tube.

2. In a continuous reed electronic organ, the gate circuite comprising a single electronic tube having plate, grid, and cathode elements, an input circuit connected to the grid and cathode elements of said tube, a plurality of continuously vibrating organ tone generator reeds, a plurality of organ keys individually manually movable from idle to playing position operatively to connect any number of said tone generators selectively to said input circuit, a source of B+ voltage, a first voltage divider connected to said source of B+ voltage and to said cathode element normally to limit amplification of said tube to a low value but not cut off, a second voltage divider connected to said source of B+ voltage, a filter for controlling attack and decay of amplification by said tube, and means operative upon movement of one of said keys from idle to playing position to interconnect said second voltage divider, said filter, and said grid element to raise the bias of said grid element relative to said cathode element for effecting a substantially higher level of amplification.

3. In a continuous reed electronic organ as set forth in claim 1, a plurality of key switches individually operable by said plurality of organ keys, said key switches including a common switch contact and a plurality of individual contacts individually operable by said keys to contact the common switch contact.

4. In a continuous reed organ as set forth in claim 3, a plurality of common contacts, and a plurality of individual contacts associated with each key and operable thereby to engage said common contacts.

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