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Blattenberger

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[54] **PREAMPLIFIER FOR MUSIC AND VOICE**

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[52] **U.S. Cl.** ..... **330/30 R,** 330/35, 330/24

[51] **Int. Cl.** **H03f 3/68**

[58] **Field of Search** ..... 330/9, 30 R, 147, 330/35, 3, 24, 124, 29

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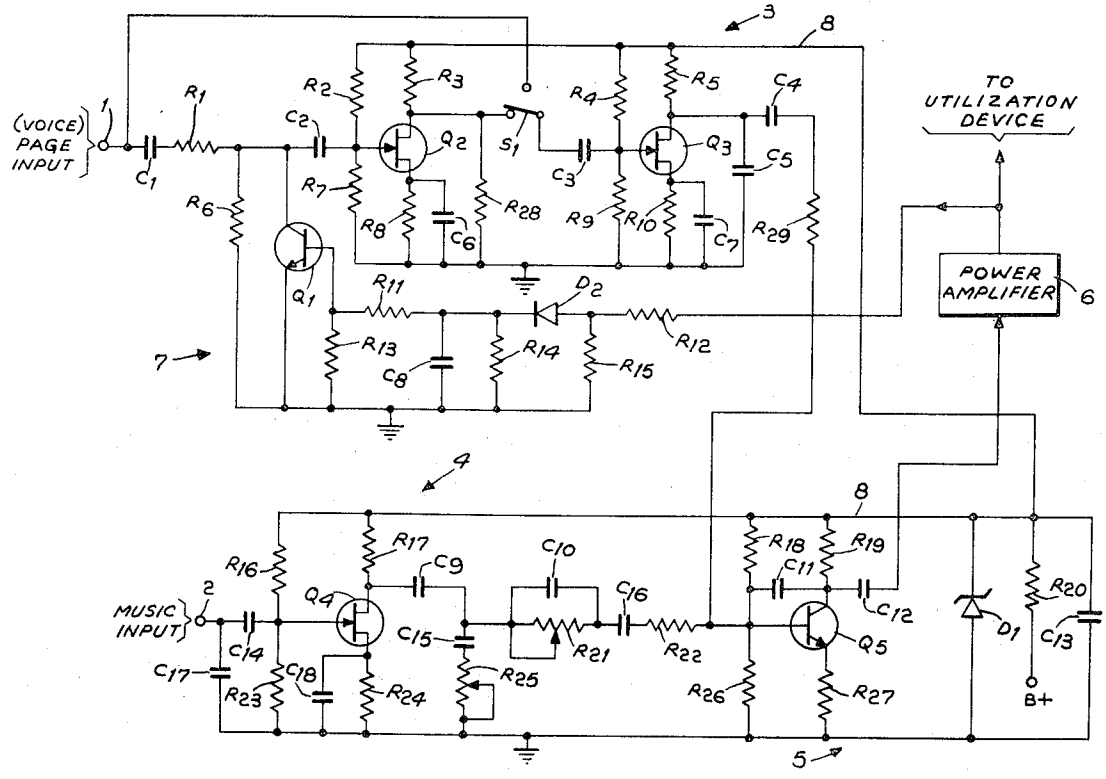
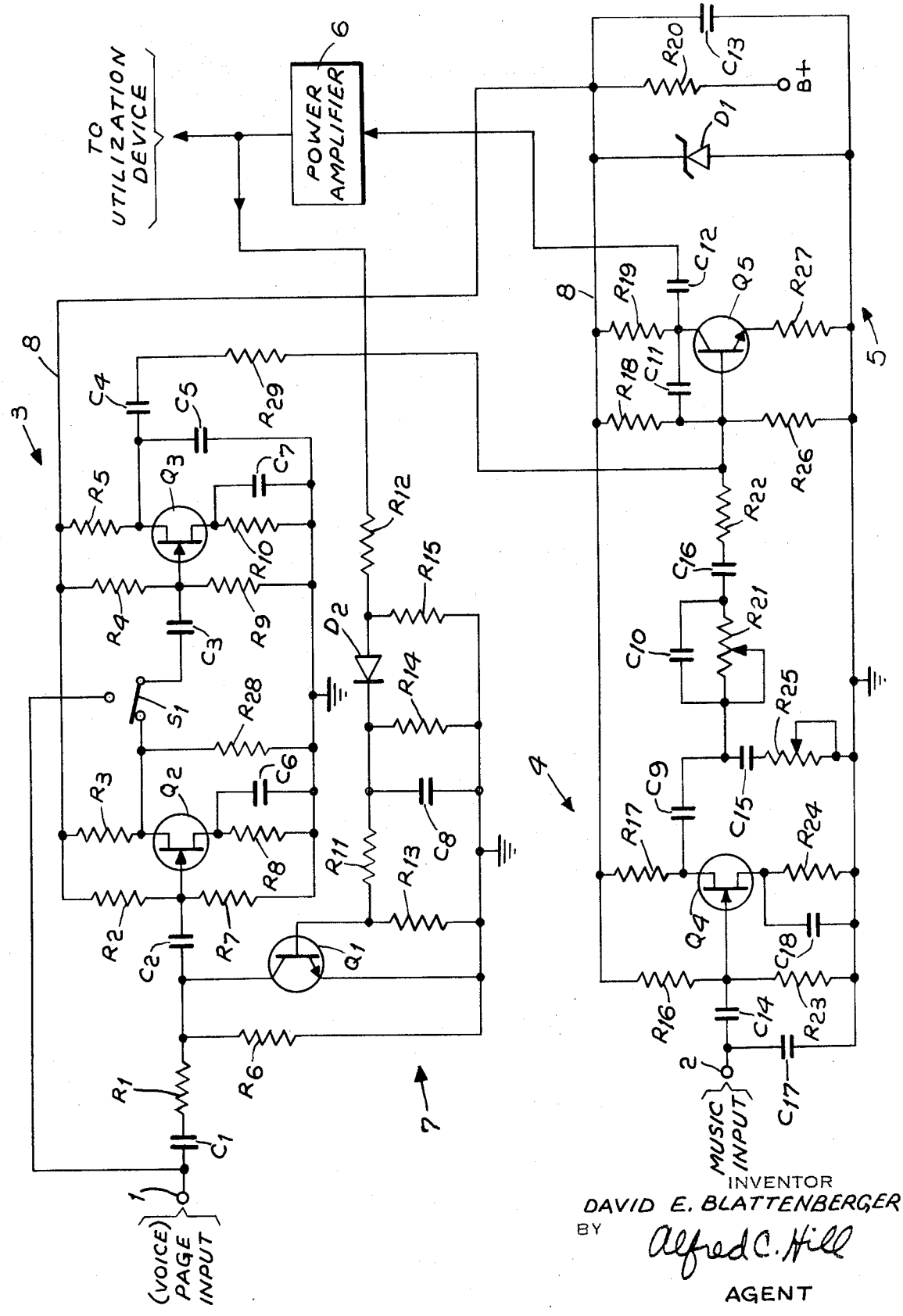
[57] **ABSTRACT**

There is disclosed a preamplifier for both music and voice that will enable achieving the best quality for both music and voice. The preamplifier includes an amplifier circuit for music whose components are adjusted or selected to provide the desired music quality and a distinct amplifier circuit for voice whose components are adjusted or selected to provide the desired voice quality. The output of these two distinct amplifier circuits are coupled to a common amplifier stage prior to being coupled to a common power amplifier. With this arrangement, a simplified automatic gain control circuit driven by the output signal of the power amplifier can be provided for the voice amplifier circuit.

2 Claims, 1 Drawing Figure





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PREAMPLIFIER FOR MUSIC AND VOICE

BACKGROUND OF THE INVENTION

This invention relates to telecommunication amplifiers and more particularly to preamplifiers for both page (voice) and music signals.

Presently existing telecommunicating amplifiers utilize preamplifiers with a single input for both page and music signals. These two signals are amplified through several amplifier stages before being applied to a power amplifier section. For application employing automatic gain control for the page signal, an expansion-compression type automatic gain control circuit is utilized to avoid distortion of the music signal.

Several shortcomings exist with this approach due to conflicting requirements necessary to achieve the best quality for both voice and music. First, boosts (the raising or adjusting of both low and high frequency for bass quality) and cuts (adjusting or lowering both low and high frequencies for treble quality) cannot be used for music because of their interaction with page quality. Page quality is improved by tapering the high frequencies. However, in doing this lower quality music results. In addition, utilization of an expansion-compression circuit for automatic gain control of the page signal is complex and expensive.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a preamplifier for both music and voice which overcomes the aforementioned difficulties.

Another object of the present invention is to provide an amplifier for music and page signals which incorporates therein separate amplifying circuits for both page and music inputs so as to overcome the aforementioned difficulties.

A feature of the present invention is the provision of a preamplifier for both voice and music inputs comprising a first source of voice; a second source of music; a first amplifier means coupled to the first source; a second amplifier means coupled to the second source; and a third amplifier means coupled in common to the output of the first and second amplifier means to provide improved quality voice and music for coupling to a utilization device.

Another feature of the present invention is the provision of a preamplifier for both voice and music inputs incorporating the above-mentioned means and further including a power amplifier coupled between the output of the third amplifier means and the utilization device; and an automatic gain control circuit coupled between the first source and the first amplifier means and to the output of the power amplifier.

BRIEF DESCRIPTION OF THE DRAWING

Above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawing in which the sole FIGURE is a schematic diagram of a preamplifier for both voice and music inputs in accordance with the principles of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in the FIGURE the difficulties of a preamplifier having a single input for both page and music signals is overcome in accordance with the principles of the present invention since the music and page signals are coupled to separate amplifier circuits. Thus, music cuts and boosts can be utilized without affecting page quality, page quality can be improved by tapering high frequency without affecting music quality and a simple automatic gain control circuit can be utilized in conjunction with the page signal amplifying circuit when required.

In accordance with the principles of the present invention the preamplifier for both voice and music inputs comprises a source of voice of page input coupled to terminal **1**, a source of music input coupled to terminal **2**, a first amplifier means **3** coupled to terminal **1**, a second amplifier means **4** coupled to terminal **2** and a third amplifier means **5** coupled in common to the output of amplifier means **3** and **4** to provide improved quality voice and music signals for coupling to a utilization device, such as a load speaker or the like. In addition, the preamplifier of the present invention further includes a power amplifier **6** coupled between the output of amplifier means **5** and the utilization device and when desired there is provided automatic gain control circuit **7** coupled between terminal **1** and amplifier means **3** and to the output of power amplifier **6**.

Amplifier means **3** includes a n-type field effect transistor **Q3** to which the page or voice input signal applied to terminal **1** is coupled by means of capacitor **C3** when switch **S1** is in the position opposite to the one shown. The signal at terminal **1** is coupled by capacitor **C3** to the gate electrode of transistor **Q3**. Resistors **R4, R5, R9** and **R10** are DC (direct current) biasing resistors for transistor **Q3**. Resistor **R4** is coupled between the gate electrode and a positive operating voltage present on bus **8** while resistor **R9** is coupled between the gate electrode and a reference potential, such as ground. Resistor **R5** is coupled between the drain electrode and bus **8** while resistor **R10** is coupled between the source electrode and ground. Capacitor **C7** in parallel with resistor **R10** improves frequency response of this amplifying stage while capacitor **C5** coupled between the drain electrode and ground has a value selected or chosen to taper high frequencies for best page quality. The output signal from transistor **Q3** is coupled from its drain electrode by the series circuit including capacitor **C4** and resistor **R29** and applied to the base electrode of an npn-type transistor **Q5** which forms the major component of amplifier means **5**. Resistor **R29** has its value adjusted or selected for desired gain of the page circuit. The overall voltage gain of amplifier means **3** with the value for resistor **R29** as shown in the TABLE presented hereinbelow is **25**. The voice signal applied to the base of transistor **Q5** is amplified and coupled by capacitor **C12** to a suitable power amplifier **6**.

In addition to transistor **Q5**, amplifier means **5** includes resistors **R18, R19, R26** and **R27** which are DC biasing resistors. Resistor **R18** is coupled between the operating potential bus **8** and the base electrode while resistor **R26** is coupled between the base electrode and ground. Resistor **R19** is coupled between the collector electrode and bus **8** while resistor **R27** is coupled between the emitter electrode and ground. Capacitor **C11** coupled between the base and collector electrodes is utilized for high frequency stability. A typical page THD (total harmonic distortion) for the page circuit without AGC is 0.5 percent.

When AGC action is required this action is obtained by switching switch S1 into the position illustrated. The output signal from power amplifier 6 is coupled to resistor R12 which has a value chosen according to the desired output from the power amplifier. The value shown in the TABLE presented hereinbelow is the typical value for a 70.7 VRMS (volts root means square) system. Resistor R15 has its value selected for desired feedback resistor level. The value for resistor R15 shown in the TABLE below supplies sufficient feedback such that with a 3 VRMS signal applied to terminal 1, a 0.7 VRMS is present at the preamplifier output (capacitor C12). The attack time of the automatic gain control circuit is determined primarily by capacitor C8 and resistor R15. Decay time for the automatic gain control circuit is determined by capacitor C8 and resistor R14. Diode D2 is a high speed diode which converts a portion of the signal coupled to resistor R12 to a DC equivalent voltage. Transistor Q1, a npn - type transistor, has its emitter connected to ground, its collector connected to terminal 1 through the series circuit of capacitor C1 and resistor R1, and its base coupled to the junction of resistors R11 and R13. Transistor Q1 acts as a voltage divider in series with resistor R1 and in shunt with resistor R6. The amount of signal transistor Q1 shunts to ground depends on the applied DC voltage coupled to its base from resistors R11 and R13. 36db (decibels) of dynamic range is obtainable by AGC action of transistor Q1 and its related components. A typical page THD with automatic gain control is 1 percent. The remainder of the automatic gain control circuit include the n-type field effect transistor Q2 which has the page input coupled through coupling capacitors C1 and C2 to its gate electrode. Resistors R2, R3, R7 and R8 are DC biasing resistors. Resistor R2 is coupled between bus 8 the gate electrode while resistor R7 is coupled between the gate electrode and ground. Resistor R3 is coupled between the drain electrode and bus 8 while resistor R8 is coupled between the source electrode and ground. Capacitor C6 coupled in shunt relation with resistor R8 is utilized for better frequency response. Resistor R28 is utilized as a load for transistor Q2 to reduce no signal noise. Transistors Q1 and Q2 and their associated circuits are used only where automatic gain control is desired. As previously mentioned, if automatic gain control is not desired switch S1 is moved to its other position and the voice (page) signal is applied directly to the gate electrode of transistor Q3 through capacitor C3.

The music input coupled to terminal 2 is coupled to amplifier 4 which includes coupling capacitor C14 to couple the music signal to the gate electrode of the n-type field effect transistor Q4. Resistors R16, R17, R23 and R24 are DC biasing resistors. Resistor R16 is coupled between bus 8 and the gate electrode while resistor 23 is coupled between the gate electrode and ground. Resistor R17 is coupled between the drain electrode and bus 8 while resistor R24 is coupled between the source electrode and ground. Capacitor C18 coupled in shunt relation to resistor R24 is utilized to improve frequency response. Transistor Q4 amplifies the music signal and capacitor C9 couples the amplified signal to cut circuits including the parallel circuit arrangement of capacitor C10 and potentiometer R21 which provides bass cut control and to the series circuit including capacitor C15 and potentiometer R25 which provides treble cut control. These two cut control circuits supply a minimum of 9db reduction in gain at 50 hertz and 10 kilohertz, respectively. The output of the base cut circuit is coupled through the series circuit including capacitor C16 and resistor R22 to the base electrode of transistor Q5. The value of resistor R22 is selected for the desired music channel gain.

The power supply for the preamplifier described herein is provided by a source of positive voltage applied to terminal B+. Terminal B+ is connected to one terminal lead of resistor R20. The other terminal lead of resistor R20 is coupled to bus 8. The value of resistor R20 is chosen by taking into consideration the value of the voltage applied to terminal B+ and the amount of ripple present in this voltage. The voltage must have a value of at least 18 voltages depending on the amount of ripple. The zener diode D1 and capacitor C13 is used for filtering the voltage applied to terminal B+ with high ripple content.

The following TABLE is a list of the values of the various components and the type of diodes and transistors employed in a reduction to practice of the circuitry shown in the drawing.

TABLE

C1=0.047 microfarad, 20 volts	R1=320 kilohms, 0.5 watt
C2=0.1 microfarad, 20 volts	R2=2.2 megohms, 0.5 watt
C3=0.33 microfarad, 20 volts	R3=10 kilohms, 0.5 watt
C4=5.0 microfarad, 20 volts	R4=2.2 megohms, 0.5 watt
C5=0.0047 microfarad, 20 volts	R5=3.9 kilohms, 0.5 watt
C6=22.0 microfarad, 20 volts	R6=33 kilohms, 0.5 watt
C7=47.0 microfarad, 20 volts	R7=2.2 megohms, 0.5 watt
C8=100.0 microfarad, 20 volts	R8=47 kilohms, 0.5 watt
C9=5.0 microfarad, 20 volts	R9=2.2 megohms, 0.5 watt
C10=0.033 microfarad, 20 volts	R10=10 kilohms, 0.5 watt
C11=50.0 picofarad, 20 volts	R11=4.7 kilohms, 0.5 watt
C12=6.4 microfarad, 20 volts	R12=4.7 kilohms, 0.5 watt
C13=200.0 microfarad, 25 volts	R13=100 kilohms, 1.0 watt
C14=0.2 microfarad, 20 volts	R14=10 kilohms, 0.5 watt
C15=0.033 microfarad, 20 volts	R15=150 ohms, 0.5 watt
C16=5.0 microfarad, 20 volts	R16=2.2 megohms, 0.5 watt
C17=0.002 microfarad, 20 volts	R17=1.5 kilohms, 0.5 watt
C18=47.0 microfarad, 20 volts	R18=150 kilohms, 0.5 watt
D1=Zener Diode, 18 volts, 0.5 watt	R19=1.5 kilohms, 0.5 watt
D2=BAX 17	R20=820 ohms, 0.5 watt
Q1=2N3390	R21=100 kilohms, 0.5 watt, potentiometer
Q2=2N5458	R22=33 kilohms, 0.5 watts
Q3=2N5458	R23=5.6 megohms, 0.5 watt
Q4=2N5458	R24=10 kilohms, 0.5 watt
Q5=2N3390	R25=25 kilohms, 0.5 watt potentiometer
B+=at least 18 volts depending on ripple	R26=12 kilohms, 0.5 watt
	R27=75 ohms, 0.5 watt
	R28=22 kilohms, 0.5 watt

The foregoing description of the drawing was directed toward a circuit employing n-type field effect transistors and npn-type transistors. It is to be understood that it is well within the skill of those working in the art to modify the circuit of the drawing to the extent of employing p-type field effect transistors in place of the n-type field effect transistors and pnp-type transistors in place of the npn-type transistors with an appropriate reversal of the polarity of the operating potential.

While I have described above the principles of my invention in connection with specific apparatus it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A preamplifier for both voice and music inputs comprising:

a first source of voice;

a second source of music;

a first amplifier means coupled to said first source;
a second amplifier means coupled to said second source;
a third amplifier means coupled in common to the output of said first and second amplifier means to provide improved quality voice and music for coupling to a utilization device;
said first amplifier means including
a positive voltage power supply,
a ground potential, and
a first n-type field effect transistor having its gate coupled to said first source, its drain coupled to said power supply through a first load resistor and its source coupled to said ground potential;
said second amplifier means including
a second n-type field effect transistor having its gate coupled to said second source, its drain coupled to said power supply through a second load resistor and its source coupled to said ground potential;
said third amplifier means including
a first npn transistor having its base coupled to the drain of both said first and second field effect transistors, its emitter coupled to said ground potential and its collector coupled to said utilization device and said power supply through a third load resistor;
a power amplifier having its input coupled to the collector of said first npn transistor and its output coupled to said utilization device;
a circuit having a semiconductor diode coupled to the output of said power amplifier to produce a direct current automatic gain control signal;
a second npn transistor having its emitter coupled to said ground potential, its collector coupled to said first source and its base coupled to said semiconductor diode, said second npn transistor being responsive to said automatic gain control signal; and
a third n-type field effect transistor having its gate coupled to said first source and the collector of said second npn transistor, its source coupled to said ground potential and its drain coupled to said power supply through a fourth load resistor and the gate of said first field effect transistor.

2. A preamplifier according to claim **1**, further including
a first capacitor coupled between the drain of said first field effect transistor and said ground potential having a value selected to provide the best voice quality;
a series circuit including a second capacitor and a first potentiometer, said series circuit being coupled between the drain of said second field effect transistor and said ground potential to adjust the treble cuts; and
a parallel circuit including a third capacitor and a second potentiometer, said parallel circuit being coupled between the drain of said second field effect transistor and the base of said first npn transistor to adjust the base cuts.

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