

Description

The present invention relates to a battery feed circuit for a pair of subscriber lines, more particularly to a battery feed circuit with an internal termination, constituted to provide a desired alternating current impedance.

A subscriber line circuit in a digital switching system is provided with so-called BORSCHT functions, e.g. battery feed, overvoltage protection, ringing, supervision, codec, hybrid, and test functions.

The present invention deals with a battery feed circuit which is arranged in a subscriber line circuit in order to carry out the battery feed function.

Battery feed circuits for supplying a d.c. speech current from an exchange to subscriber lines or trunk circuits are generally constructed to provide a direct current feed resistance of, for instance, 200 ohms or 220 ohms and a high alternating current termination impedance to prevent a voice signal from transmission. It is required in a subscriber line for alternating current to be terminated by a predetermined a.c. impedance (for instance, 600 ohms). For satisfying these requirements, there is available in the prior art a battery feed circuit which uses inductance elements such as a transformer, coil or other devices and a termination circuit with a predetermined alternating current impedance. Such battery feed circuits, however, are not suitable for recent integrated circuits and large-scale integrated circuits. For this reason, it is expected that the battery feed circuit be constituted only by electronic components such as transistors. As it is necessary that such electronic feed circuits operate as with inductance components, they are designated as electronic inductance circuits. These provide an alternating current impedance of tens of kilohms or more. Since they exhibit a very high a.c. impedance, a circuit having a termination impedance of, for instance, 600 ohms must be added. Here, it should be noted that while it is possible to cancel alternating current induced voltage (longitudinal mode signal) with coils or transformers, this is not possible with the above-described electronic inductance circuit. In other words, since the ground impedance for the induced noise is high, e.g. tens of kilohms, the induced a.c. voltage cannot be suppressed and it becomes excessively high, surpassing the power supply voltage of internal components, such as operational amplifiers in the electronic inductance circuit. This results in saturation distortion in the alternating current signal and thus distortion in the voice signal. Therefore, the disadvantage results of insufficient ability to withstand alternating current induced noise.

GB-A-2093314 discloses a further battery feed circuit having a common mode feedback circuit which monitors a neutral potential between the two subscriber lines. A pair of bi-directional current sources are provided and are controlled by the common mode feedback circuit in such manner that a neutral potential should reach a predetermined value. The circuit requires the subscriber lines to be coupled together through a pair of series connected resistors. This accordingly forms a loop circuit in the subscriber line and may give rise to oscillation problems.

It is an object of the present invention to provide a battery feed circuit utilizing an electronic inductance circuit, which can provide a desired alternating current termination impedance without giving rise to unwanted oscillations.

It is another object of the present invention to provide a battery feed circuit utilizing an electronic inductance circuit, wherein the ability to withstand alternating current induced noise is improved due to low ground impedance.

According to the present invention, there is provided a battery feed circuit for first and second subscriber lines (A, B) in a subscriber line pair having an alternating current terminal impedance and for receiving input signals, said battery feed circuit comprising: a first voltage drive circuit, operatively connected to the first subscriber line (A), in parallel with a first current source circuit and including a first operational amplifier circuit having d.c. voltage feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair; and a second voltage drive circuit, operatively connected to the second subscriber line in parallel with a second current source circuit and including a second operational amplifier circuit having d.c. voltage feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair, wherein voice signals and induced noise signals are terminated by said first and second voltage drive circuits.

The invention will now be explained in greater detail with reference to embodiments thereof which are represented in the accompanying drawings, wherein:

Fig. 1 is a block diagram of a subscriber line circuit in a digital switching system;

Fig. 2 shows a prior art battery feed circuit using an equivalent inductance circuit;

Fig. 3 is a waveform of an induced noise signal and distortion of a voice signal in a subscriber line;

Fig. 4 is a circuit diagram of a battery feed circuit for a pair of subscriber lines as an embodiment in accordance with the present invention;

Fig. 5 is an explanatory view of waveforms of a voice signal in line A and line B, respectively, in a longitudinal mode and transverse mode; and

Fig. 6 is a circuit diagram of a battery feed circuit as an alternative embodiment in accordance with the present invention.

Description of the preferred embodiments

Before describing the preferred embodiments, a more detailed look will be taken of the related art.

Fig. 1 is a simplified block diagram of a subscriber line circuit in a digital switching system. A digital or an analog telephone is connected with a subscriber line circuit through a main distribution frame. The subscriber line circuit contains a battery feed circuit and is connected to a switching network.

Fig. 2 shows a prior art battery feed circuit in a subscriber line circuit using an equivalent inductance circuit. In the figure, A and B denote subscriber lines, 2 and 3 circuits for forming electronic inductance, 1 terminating equipment and hybrid circuit, and T a transformer. Reference numerals 21 and 31 denote transistors, 20 and 30 operational amplifiers, 22 to 25 and 32 to 35 resistors, 26, 36, and 9 capacitors, $-V_{BB}$, for instance, a power supply voltage of -48 V, and G the ground.

Circuits 2 and 3 for forming electronic inductance supply direct current to line A and line B and are symmetrical in constitution. The circuits function so that alternating current signals are diverted by the capacitors 26 and 36 and so that the transistors 21 and 31 are controlled by the operational amplifiers 20 and 30, so the voltage across the resistors 22 and 32 becomes equal to the voltage across the resistors 23 and 33.

Accordingly, the electronic inductance circuits impose a d.c. feed resistance on the lines A and B as follows:

$$R_{25}(R_{22}+R_{23})/R_{22}=R_{35}(R_{32}+R_{33})/R_{32} \quad (1)$$

where the subscripts of "R" denote the corresponding resistors in Fig. 2. The electronic inductance circuits exhibit an a.c. ground impedance between line B and the ground G and between line A and the power supply as follows:

$$R_{22}+R_{23}=R_{32}+R_{33} \quad (2)$$

Generally, the resistors 22 through 25 and 32 through 35 are set so that the feeding resistance for direct current becomes 200 ohms or so, as described above. The electronic inductance circuits 2 and 3 operate as if they have an inductance component, as the name implies, so they have an a.c. impedance of tens of kilohms or more because the resistance of resistors 22, 23, 32, 33 is set to a high resistance value.

As described above, since the feed circuit as shown in Fig. 2 exhibits very high a.c. impedance, a circuit having a termination impedance of, for instance, 600 ohms required for terminating the alternating current signal (the voice signal which is a transverse mode signal) from the subscriber line or trunk line must be added other than a battery feed circuit. But the ground impedance is high, e.g., tens of kilohms for an alternating current signal (the induced noise which is a longitudinal mode), so that the alternating current induced voltage which cannot be suppressed becomes high, surpassing the power supply voltage of the operational amplifiers 20 and 30 in the electronic inductance circuit. This results in the previously discussed problems. Fig. 3 shows the distortion in the voice signal arising due to the above problems.

In the off-hook state, direct current is supplied from the battery feed circuit and the subscriber lines are at a predetermined direct current potential.

The alternating current induced voltage is applied between the subscriber lines and the ground. When the alternating current induced voltage is low as shown in the region T_{1N} and T_{2N} , the voice signal superposed thereupon does not distort, which is shown by small superposed waveforms. On the contrary, as shown from the point T_{1D} on, when the alternating current induced voltage is high, a part of the waveforms is broken off, so the voice signal superposed on the broken part is interrupted and distorts. For this reason, it is necessary that a high induced a.c. voltage not be applied thereto.

Fig. 4 is a circuit diagram of a battery feed circuit for a pair of subscriber lines as an embodiment in accordance with the present invention. In Fig. 4, voltage drive circuits 4 and 5 are connected in parallel with the electronic inductance circuits 2 and 3, respectively.

The voltage drive circuits 4 and 5 are composed of operational amplifiers 40 and 50, resistor 42 through 46 and 52 through 56, and capacitors 41, 49, 51, and 59. G is the ground, $-V_{BB}$ a power supply voltage, and $+v_s$ and $-v_s$ alternating current signals for sending from a feed circuit side to subscriber line or a trunk line side.

In the voltage drive circuits 4 and 5, the feedback resistors 43 and 53 are connected between the output terminals of the operational amplifiers 40 and 50 and their inverting input terminals, respectively. The direct current voltages of line A and line B are fed back to the non-inverting input terminal of the operational amplifiers 40 and 50 through the feedback resistors 44, 45 and 54, 55, thus setting the d.c. operating point of the operational amplifiers 40 and 50, respectively. Coupling capacitors 41 and 51 are connected with the inverting input terminals of the operational amplifiers 40 and 50 through the resistors 42 and 52, respectively, to interrupt a direct current. Due to the direct current isolation of the coupling capacitors, the operational amplifiers 40 and 50 become voltage followers for direct current. The reason why the operational amplifiers 40 and 50 are made voltage followers for direct current is that the direct current potential difference across the resistors 46 and 56 is zero and the direct current output current and the direct current power loss is zero.

Each of the operational amplifiers 40 and 50 which has a gain $R_{43}/R_{42}=R_{53}/R_{52}$, operates as an inverting

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amplifier with respect to an alternating current signal v_s , and provides an inverting amplifier output to the output of the operational amplifier 40, based upon the action of the resistors 42, 43, 52, and 53 and the capacitors 49 and 59, which bypass the alternating current signal.

Generally speaking, the output resistance of an operational amplifier is so low that it may be regarded as zero. The direct current output voltage of the operational amplifiers 40 and 50 is equivalent to the direct current voltage of line A and line B, as described before, so the potentials across the resistors 46 and 56 becomes equal. Therefore, the resistors 46 and 56 are not present in the d.c. current path. As the internal impedance of the operational amplifiers 40 and 50 viewed from the output terminal is sufficiently low compared with the resistance of the resistors 46 and 56, the impedances between line A and line B and the power source or the ground G are equivalent to the value of the resistors 46 and 56 for the alternating current component, respectively.

If the resistors 46 and 56 are made $Z_T/2$, the inverting amplifiers, composed of the operational amplifiers 40 and 50, in the voltage drive circuits 4 and 5 become alternating current voltage sources, in which the output voltage is

$$v_s \cdot R_{43}/R_{42} = v_s \cdot R_{53}/R_{52},$$

and the output impedance is

$$Z_T/2 = R_{46} = R_{56},$$

where Z_T denotes a desired alternating current terminal impedance and is made, for instance, 600 ohms.

As line A and line B are both balanced types, the above-mentioned feed circuit divides the alternating current terminal impedance of Z_T into two equal components. Moreover, the resistors 46 and 56 are set so that the output impedance becomes equal to $Z_T/2$ in the voltage drive circuits 4 and 5.

Since the voltage drive circuits 4 and 5 have an output impedance of $Z_T/2$, when an alternating current signal is input from the line A side and the line B side, due to the fact that the above-described alternating current signal v_s is zero and the internal impedances of the operational amplifiers 40 and 50 viewed from the output terminal are sufficiently low compared with the resistances R_{46} and R_{56} of the resistors 46 and 56, the impedances of the voltage drive circuits 4 and 5 viewed from line A, and line B are equal to R_{46} and R_{56} , that is to say, to $Z_T/2$, and the voltage drive circuits 4 and 5 terminate to the power supply side and the ground. On the other hand, the impedances of the electronic inductance circuits 2 and 3 to the alternating current are sufficiently high compared with the output impedances $Z_T/2$ of the voltage drive circuits 4 and 5. Also, the voltage drive circuits 4 and 5 are connected in parallel to the electronic inductance circuits 2 and 3 between the power supply $-V_{BB}$ and the ground G. Therefore, the input alternating current signal cannot flow through the electronic inductance circuits 2 and 3, but flows directly through the voltage drive circuits 4 and 5. The impedances of line A and line B with the power source and the ground G are equivalent to $Z_T/2$, as with the output impedance of the voltage drive circuits 4, 5.

As shown in Fig. 5, when the alternating current signals at the line A side and line B side are in a transverse mode of a voice signal, voltage is applied between line A and line B and the impedance between the power source and the ground can be regarded as zero, so the input alternating current signals run from the voltage drive circuit 5 via the power source and the ground even through the voltage drive circuit 4 into the line A side. Therefore, the sum of the output impedances of the voltage drive circuits 4 and 5, that is,

$$Z_T/2 + Z_T/2 = Z_T$$

exists between line A and line B, and the alternating current terminal impedance between line A and line B is the desired value Z_T .

On the contrary, when the alternating current signals are in a longitudinal mode due to the alternating current induced noise voltage, the alternating current signals are applied in a longitudinal mode both between line A and the ground and between line B and the ground. Consequently, $Z_T/2$ appears in the voltage drive circuit 4 between line A and the power supply $-V_{BB}$, while $Z_T/2$ appears in the voltage drive circuit 5 between line B and the ground G. That is to say, with regard to the transverse mode signal, the circuit is terminated with the desired impedance Z_T . With regard to the longitudinal mode signal, the circuit is terminated with as low as half of the termination impedance Z_T . Due to the parallel-connection voltage drive circuits 4 and 5, no excessive voltage occurs in the electronic inductance circuit 2 and 3 with a high ground impedance and, so, no distortion of the voice signal occurs. Thus, there is the advantage of a large ability to withstand alternating current induced noise.

Fig. 6 is a circuit diagram showing an alternative embodiment in accordance with the present invention, in which elements equivalent to those in Fig. 4 are denoted by the same symbols. In the figure, 6 and 8 are voltage drive circuits, 61 and 81 transistors, 60 and 80 operational amplifiers, and 62 through 68 and 82 through 88 resistors. The electronic inductance circuits 2 and 3 have the same constitution as shown in Fig. 4. Compared with the voltage drive circuits 4 and 5 shown in Fig. 4, the voltage drive circuits 6 and 8 are given an added feed function by means of the transistors 61 and 81.

The operational amplifiers 60 and 80, composed of transistors 61 and 81, are inverting amplifiers

having the gain

$$R_{65}/R_{66}=R_{85}/R_{86}$$

5 with an alternating current signal v_s , as in Fig. 4, and are each voltage followers for direct current. In Fig. 6, the voltage between line A and the power supply voltage $-V_{ss}$ and the voltage line between line B and the ground G are divided separately by resistors 62, 63, and 82, 83 and, moreover, added to the non-inverting input terminal of the operational amplifiers 60 and 80 through the feedback resistors 67, 68 and 87, 88. Then, as the operational amplifiers 60 and 80 are voltage followers, a direct current voltage equivalent to
10 the direct current voltage across the resistors 63 and 83 is added to both ends of the resistors 64 and 84. The feed current flows through the transistor 61 and resistor 64 and the transistor 81 and resistor 84. The then direct current feed resistors of the voltage drive circuits 6 and 8, when

$$R_{64}=R_{84}=Z_T/2,$$

15 are

$$(Z_T/2)(R_{62}+R_{63})/R_{63}=(Z_T/2)(R_{82}+R_{83})/R_{83} \quad (3)$$

With regard to an alternating current signal, the voltage drive circuits 6 and 8 are the same as the voltage drive circuits 4 and 5 in Fig. 4 and serve as the power source of alternating current voltages of
20 which the output voltage is

$$V_s \cdot R_{65}/R_{66}=V_s \cdot R_{85}/R_{86}$$

and the output impedance is

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$$Z_T/2=R_{64} \text{ or } R_{84}.$$

With regard to line A, the d.c. feed current of the entire circuit is the sum of the currents which flow through the transistor 21 of the electronic inductance circuit 2 and the transistor 61 of the voltage drive circuit 6. With regard to line B, the d.c. feed current of the entire circuit is the sum of the currents which flow
30 through the transistor 31 of the electronic inductance circuit 3 and the transistor 81 of the voltage drive circuit 8. Accordingly, the direct current feed resistance of the entire circuit in Fig. 6 is the parallel composite resistance of the feed resistors of the electronic inductance circuits 2 and 3 and the voltage drive circuits 6 and 8, i.e.,

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$$(R_{35} \cdot \frac{R_{32}+R_{33}}{R_{32}}) // (\frac{Z_T}{2} \cdot \frac{R_{82}+R_{83}}{R_{83}})$$

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$$=(R_{25} \cdot \frac{R_{22}+R_{23}}{R_{22}}) // (\frac{Z_T}{2} \cdot \frac{R_{82}+R_{83}}{R_{83}}) \quad (4)$$

The a.c. termination impedance is Z_T with a transverse mode signal and $Z_T/2$ with a longitudinal mode signal, as in the embodiment of Fig. 4.

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In comparison with the embodiment as shown in Fig. 4, the embodiment of Fig. 6, provides a larger a.c. drive current. Moreover, the d.c. feed current is split between transistors 21, 61 and 31, 81, resulting in less problem with heat buildup.

Claims

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1. A battery feed circuit for first and second subscriber lines (A, B) in a subscriber line pair having an alternating current terminal impedance and for receiving input signals, said battery feed circuit comprising:
a first voltage drive circuit (4, 6), operatively connected to the first subscriber line (A) in parallel with a first current source circuit (2) and including a first operational amplifier circuit having d.c. voltage feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair; and
55 a second voltage drive circuit (5, 8), operatively connected to the second subscriber line (B) in parallel with a second circuit source circuit (3) and including a second operational amplifier circuit having d.c. feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair, wherein voice signals and induced noise signals are terminated by said first and second voltage drive circuits (4, 5; 6, 8).

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2. A battery feed circuit according to claim 1, wherein each of said first and second operational amplifier circuits is a voltage follower for direct current.

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3. A battery feed circuit according to claim 1 or 2, wherein each of said first and second operational amplifier circuits is arranged to operate as an inverting amplifier for alternating current.

having the gain

$$R_{65}/R_{66}=R_{85}/R_{86}$$

5 with an alternating current signal v_s , as in Fig. 4, and are each voltage followers for direct current. In Fig. 6, the voltage between line A and the power supply voltage $-V_{ss}$ and the voltage line between line B and the ground G are divided separately by resistors 62, 63, and 82, 83 and, moreover, added to the non-inverting input terminal of the operational amplifiers 60 and 80 through the feedback resistors 67, 68 and 87, 88. Then, as the operational amplifiers 60 and 80 are voltage followers, a direct current voltage equivalent to the direct current voltage across the resistors 63 and 83 is added to both ends of the resistors 64 and 84. The feed current flows through the transistor 61 and resistor 64 and the transistor 81 and resistor 84. The then direct current feed resistors of the voltage drive circuits 6 and 8, when

$$R_{64}=R_{84}=Z_T/2,$$

15 are

$$(Z_T/2)(R_{62}+R_{63})/R_{63}=(Z_T/2)(R_{82}+R_{83})/R_{83} \quad (3)$$

20 With regard to an alternating current signal, the voltage drive circuits 6 and 8 are the same as the voltage drive circuits 4 and 5 in Fig. 4 and serve as the power source of alternating current voltages of which the output voltage is

$$V_s \cdot R_{65}/R_{66}=V_s \cdot R_{85}/R_{86}$$

and the output impedance is

$$25 \quad Z_T/2=R_{64} \text{ or } R_{84}.$$

30 With regard to line A, the d.c. feed current of the entire circuit is the sum of the currents which flow through the transistor 21 of the electronic inductance circuit 2 and the transistor 61 of the voltage drive circuit 6. With regard to line B, the d.c. feed current of the entire circuit is the sum of the currents which flow through the transistor 31 of the electronic inductance circuit 3 and the transistor 81 of the voltage drive circuit 8. Accordingly, the direct current feed resistance of the entire circuit in Fig. 6 is the parallel composite resistance of the feed resistors of the electronic inductance circuits 2 and 3 and the voltage drive circuits 6 and 8, i.e.,

$$35 \quad \left(R_{95} \cdot \frac{R_{32}+R_{33}}{R_{32}} \right) \parallel \left(\frac{Z_T}{2} \cdot \frac{R_{82}+R_{83}}{R_{83}} \right) \\ 40 \quad = \left(R_{25} \cdot \frac{R_{22}+R_{23}}{R_{22}} \right) \parallel \left(\frac{Z_T}{2} \cdot \frac{R_{62}+R_{63}}{R_{63}} \right) \quad (4)$$

The a.c. termination impedance is Z_T with a transverse mode signal and $Z_T/2$ with a longitudinal mode signal, as in the embodiment of Fig. 4.

45 In comparison with the embodiment as shown in Fig. 4, the embodiment of Fig. 6, provides a larger a.c. drive current. Moreover, the d.c. feed current is split between transistors 21, 61 and 31, 81, resulting in less problem with heat buildup.

Claims

50 1. A battery feed circuit for first and second subscriber lines (A, B) in a subscriber line pair having an alternating current terminal impedance and for receiving input signals, said battery feed circuit comprising: a first voltage drive circuit (4, 6), operatively connected to the first subscriber line (A) in parallel with a first current source circuit (2) and including a first operational amplifier circuit having d.c. voltage feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair; and

55 a second voltage drive circuit (5, 8), operatively connected to the second subscriber line (B) in parallel with a second circuit source circuit (3) and including a second operational amplifier circuit having d.c. feedback and output impedances determined by the input signals and the alternating current terminal impedance for the subscriber line pair, wherein voice signals and induced noise signals are terminated by said first and second voltage drive circuits (4, 5; 6, 8).

60 2. A battery feed circuit according to claim 1, wherein each of said first and second operational amplifier circuits is a voltage follower for direct current.

65 3. A battery feed circuit according to claim 1 or 2, wherein each of said first and second operational amplifier circuits is arranged to operate as an inverting amplifier for alternating current.



4. A battery feed circuit according to claim 1, 2 or 3, wherein said voltage drive circuits provide an impedance Z_T for the voice signals in a transverse mode and an impedance $Z_T/2$ for induced longitudinal noise signals.

5. A battery feed circuit according to any preceding claim further comprising:

first battery feed means (61), operatively connected to the output of said first operational amplifier circuit, the direct current supply and the first subscriber line, for supplying direct current to the first subscriber line; and

second battery feed means (81), operatively connected to the output of said second operational amplifier, the direct current supply and the second subscriber line, for supplying direct current to the second subscriber line.

Patentansprüche

1. Speiseschaltung für erste und zweite Teilnehmerleitungen (A, B) in einem Teilnehmerleitungspaar mit einer Wechselstromabschlußimpedanz und zum Empfangen von Eingangssignalen, wobei die Speiseschaltung umfaßt:

einen ersten Spannungstreiberschaltkreis (4, 6), welcher betriebsmäßig mit der ersten Teilnehmerleitung (A) verbunden und parallel zu einem ersten Stromquellenschaltkreis (2) geschaltet ist und einen ersten Operationsverstärkerschaltkreis einschließt, welcher eine Gleichspannungsrückkopplung und Ausgangsimpedanzen hat, welche von den Eingangssignalen und der Wechselstromabschlußimpedanz für das Teilnehmerleitungspaar bestimmt werden; und

einen zweiten Spannungstreiberschaltkreis (5, 8), welcher betriebsmäßig mit der zweiten Teilnehmerleitung (B) verbunden und parallel zu einem zweiten Stromquellenschaltkreis (3) geschaltet ist und einen zweiten Operationsverstärkerschaltkreis einschließt, welcher eine Gleichspannungsrückkopplung und Ausgangsimpedanzen hat, welche von den Eingangssignalen und der Wechselstromabschlußimpedanz für das Teilnehmerleitungspaar bestimmt werden, worin Gesprächssignale und induzierte Störsignale durch die ersten und zweiten Spannungstreiberschaltkreise (4, 5; 6, 8) abgeschlossen werden.

2. Speiseschaltung nach Anspruch 1, dadurch gekennzeichnet, daß jeder der ersten und zweiten Operationsverstärkerschaltkreise ein Spannungsfolger für Gleichstrom ist.

3. Speiseschaltung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß jeder der ersten und zweiten Operationsverstärkerschaltkreise angeordnet ist, als invertierender Verstärker für Wechselstrom zu arbeiten.

4. Speiseschaltung nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die Spannungstreiberschaltkreise eine Impedanz Z_T für die Stimmsignale in einem Quermodus und eine Impedanz $Z_T/2$ für induzierte Längsstörsignale vorsehen.

5. Speiseschaltung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß sie ferner umfaßt:

erste Speiseeinrichtungen (61), welche betriebsmäßig mit dem Ausgang des ersten Operationsverstärkerschaltkreises, der Gleichstromversorgung und der ersten Teilnehmerleitung verbunden sind, um Gleichstrom an die erste Teilnehmerleitung zu liefern; und

zweite Speiseeinrichtungen (81), welche betriebsmäßig mit dem Ausgang des zweiten Operationsverstärkers, der Gleichstromversorgung und der zweiten Teilnehmerleitung verbunden sind, um Gleichstrom an die zweite Teilnehmerleitung zu liefern.

Revendications

1. Circuit d'alimentation pour des première et seconde lignes d'abonné (A, B) d'une paire de lignes d'abonné ayant une certaine impédance terminale en courant alternatif et permettant de recevoir des signaux d'entrée, le circuit d'alimentation comprenant:

un premier circuit de commande de tension (4, 6), relié de manière opérationnelle à la première ligne d'abonné (A), en parallèle avec un premier circuit de source de courant (2) et incluant un premier circuit d'amplificateur opérationnel ayant une boucle de réaction en tension continue et une sortie dont les impédances sont déterminées par les signaux d'entrée et par l'impédance terminale en courant alternatif pour la paire de lignes d'abonné; et

un second circuit de commande de tension (5, 8), relié de manière opérationnelle à la seconde ligne d'abonné (B) en parallèle avec un second circuit de source de courant (3) et comportant un second circuit d'amplificateur opérationnel ayant une boucle de réaction en tension continue et une sortie dont les impédances sont déterminées par les signaux d'entrée et par l'impédance terminale en courant alternatif pour la paire de lignes d'abonné, dans lequel des signaux vocaux et des signaux de bruit induits sont reçus par les premier et second circuits de commande de tension (4, 5; 6, 8).

2. Circuit d'alimentation selon la revendication 1, dans lequel chacun des premier et second circuits d'amplificateur opérationnel est un suiveur de tension continue.

3. Circuit d'alimentation selon la revendication 1 ou la revendication 2, dans lequel chacun des premier et second circuits d'amplificateur opérationnel est conçu de manière à fonctionner comme un amplificateur inverseur pour un courant alternatif.



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4. Circuit d'alimentation selon l'une des revendications 1, 2 ou 3, dans lequel les circuits de commande de tension fournissent une impédance Z_T pour les signaux vocaux dans un mode transversal et une impédance $Z_T/2$ pour des signaux de bruit longitudinaux induits.

5. Circuit d'alimentation selon l'une quelconque des revendications précédentes, comprenant en outre:
5 un premier moyen d'alimentation (61) relié de manière opérationnelle à la sortie du premier circuit d'amplificateur opérationnel, à l'alimentation en courant continu ainsi qu'à la première ligne d'abonné, pour fournir du courant continu à la première ligne d'abonné; et
un second moyen d'alimentation (81) relié de manière opérationnelle à la sortie du second amplificateur opérationnel, à l'alimentation en courant continu ainsi qu'à la seconde ligne d'abonné, pour
10 fournir du courant continu à la seconde ligne d'abonné.

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