

[54] **PSEUDO BALANCED CONSTANT CURRENT SUPPLY**

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 [58] Field of Search **323/1, 4, 7, 8, 16, 19, 323/40**

[56] **References Cited**
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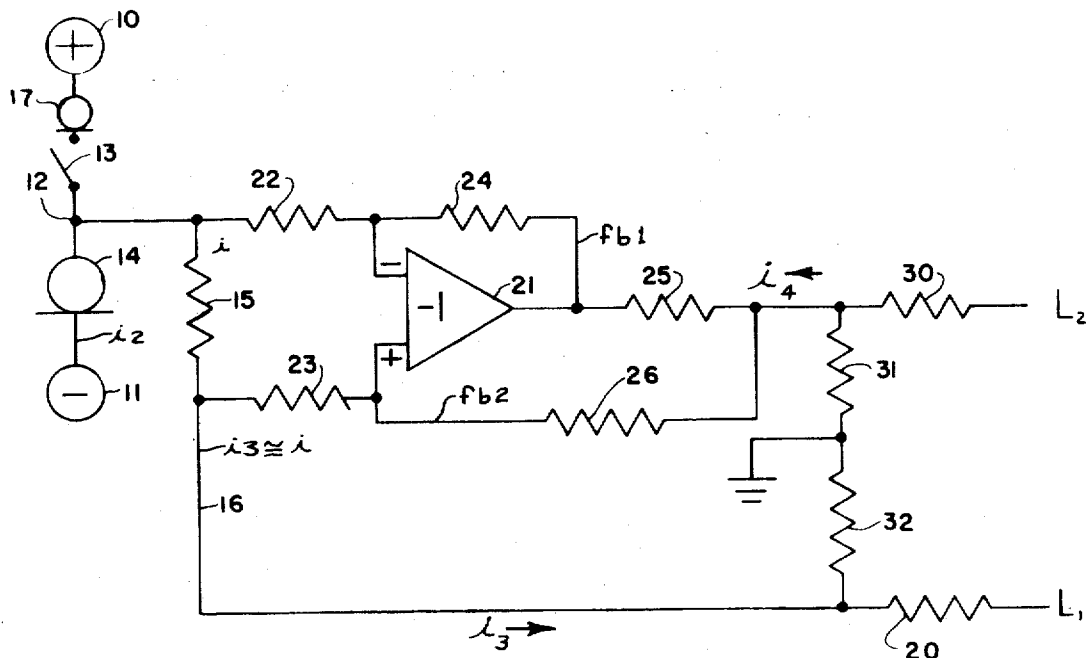
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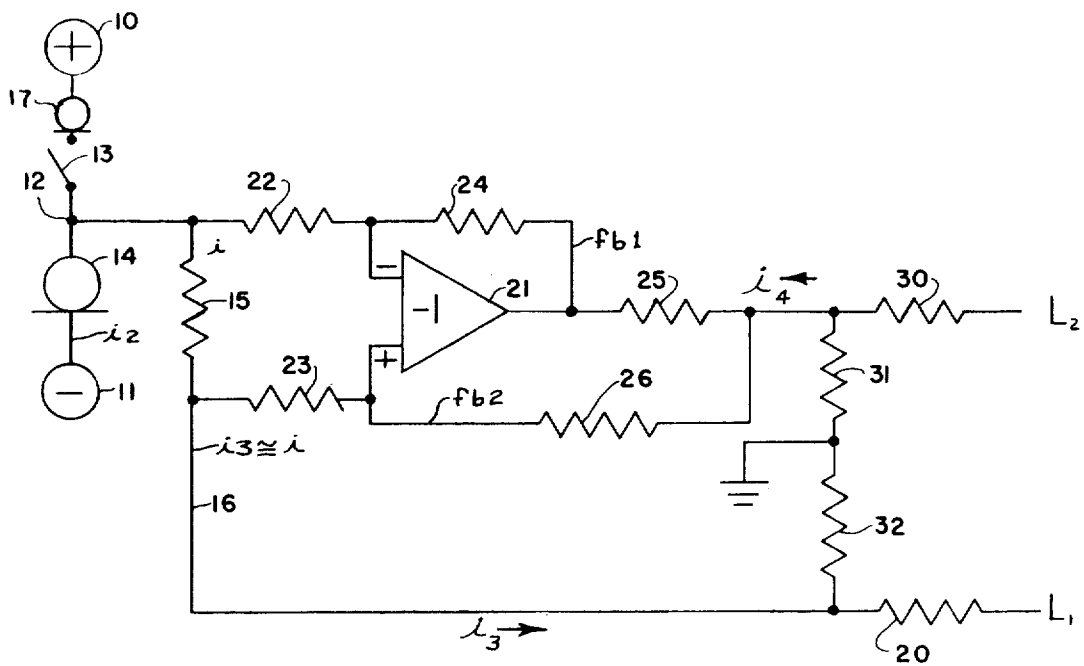
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[57] **ABSTRACT**

An electronic circuit designed particularly for data communications systems for providing equal and opposite current to a pair of line conductors. The circuit employs an operational amplifier with a sampling resistance connected in series with a current supply. The sampling resistance provides the input signal to the operational amplifier. Dual feedback is provided with one feedback path including a resistance matching the sampling resistance.

3 Claims, 1 Drawing Figure





PSEUDO BALANCED CONSTANT CURRENT SUPPLY

BACKGROUND OF THE INVENTION

One form of data transmission systems employs voltage or more correctly, current reversals to indicate a 1 or a 0. In theory, such a system is simply represented by battery connected to a transmission line with a reversing switch to alternately apply plus and minus potential to the line conductors. At the opposite end of the transmission line the battery voltage less estimated line losses is detected.

In producing such data systems which provide the most reliable transmission through two conductor unloaded channels, optimum reliability is achieved when a constant current rather than constant voltage source is used.

Conventional constant current supply circuits often employ operational amplifiers as taught by Schilling and Belove in *Electronic Circuits Discrete and Integrated*, McGraw Hill Book Co., N.Y.N.Y., copyright 1963, pages 299-301, and by Morrison in *D.C. Amplifiers in Instrumentation*, John Wiley and Sons, Inc., N.Y.N.Y., copyright 1970, pages 126-131. Also, Esaki or tunnel diode circuits are employed as constant current sources as described by Roddam in *Transistor Inverters and Converters*, D. Van Nostrand, Cox, Inc., Newark, N.J., Copyright 1963.

None of these circuits however, are designed to supply current of equal magnitude and opposite direction to a pair of lines regardless of the impedance of either line.

BRIEF STATEMENT OF THE INVENTION

I have determined that the production of an effective constant current generator can be achieved by applying a constant voltage source to a line, sampling in a precision resistance the current and employing the voltage drop across the precision resistance as the input voltage to an operational amplifier. There are two feedback paths for the operational amplifier, one to each side of the input resistance. One feedback current is taken directly from the output of the operational amplifier and the second across a matching output of the operational amplifier and the second across a matching output resistance.

The net effect is that the output of the operational amplifier is a current equal and opposite to the current sensed.

BRIEF DESCRIPTION OF THE DRAWING

This invention may be more clearly understood from the following detailed description and by reference to the drawing which is an electrical schematic diagram of the circuit of this invention.

DETAILED DESCRIPTION OF THE INVENTION

Now referring to the drawing, a constant current source designed to apply current of reversing direction to a pair of line conductors is shown. It employs a pair of opposite polarity voltage terminals 10 and 11 connected to a common junction 12. The positive terminal 10 is connected through a current source 17 and a normally open switch 13 which may be a solid state switching device. The negative terminal 11 is connected through constant current diode 14. Junction 12 is connected via a precision resistance 15, conductor 16 and

line resistance 20 to one line conductor L_1 of a pair of line conductors L_1 and L_2 .

The resistance 15 is in actuality connected across the input terminals of an operational amplifier 21 via a pair of equal value resistances 22 and 23. So connected, the voltage input to the differential amplifier 21 is a function of the current i through resistance 15. The resistances 22 and 23 and the input impedance of the amplifier 21 are high so the current i substantially equals the line current i_3 on the conductor L_1 .

The output of operational amplifier 21 includes a pair of feedback paths fb1 and fb2, one directly from the output via resistance 24 to the negative (-) input terminal of the amplifier 21. A second feedback path is present, taken from a point in the output following a resistance 25 which matches the input resistance 15. The second feedback path including a resistance 26 is applied to the positive (+) input terminal of the operational amplifier 21.

A second line resistance 30 and a matched pair of resistances 31 and 32 with their center tap grounded complete the circuit. The current i_4 on line L_2 is substantially equal to and of opposite to i_3 regardless of the impedance of line L_1, L_2 and therefore a substantially balanced current source is produced. This circuit is termed a pseudo balanced constant current source since it is not strictly balanced but senses current in one line of a two conductor system and generates an equal and opposite current for the other line while not being symmetrical in form.

Typical values for components are:

Supply	10	+12 v DC
do.	11	-12 v DC
Diode	14	1 N 5309
Switch	13	EN 2907 Transistor
Resistances	15 & 25	100 2%
Resistances	20, 22, 23,	47K 2%
	24, 26, 30,	
	31, 32	
Amplifier	21	Type 741

I claim:

1. Current supply circuit for a pair of line conductors comprising:

a voltage supply;

said voltage supply comprising a negative polarity constant current source and a positive polarity constant current source and switch means for selectively applying one or both of said constant current sources to a common output terminal of said voltage supply;

a pair of line conductors;

a first resistance connected in series between the said output terminal of said supply and the first of said pair of line conductors;

an amplifier having a gain of substantially minus one and a pair of input terminals;

means connecting the input terminals of said amplifier to the opposite ends of said first resistance whereby the input voltage to said amplifier is a voltage drop proportional to the current in the first of said pair of line conductors;

a first feedback path from the output of said amplifier to one of said pair of input terminals;

a second resistance equal in value to said first resistance and connected in series with the output of said amplifier and the second of said line conductors; and

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a second feedback path between the end of said second resistance remote from said amplifier to the second of said pair of input terminals of said amplifier.

2. The combination in accordance with claim 1 wherein said first and second feedback paths include equal value resistances.

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3. The combination in accordance with claim 1 wherein a pair of equal resistances are connected in series between respective ends of said first resistance and the input terminals of said amplifier and said pair of equal resistances have values in the order of several times the resistance of said first resistance.

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