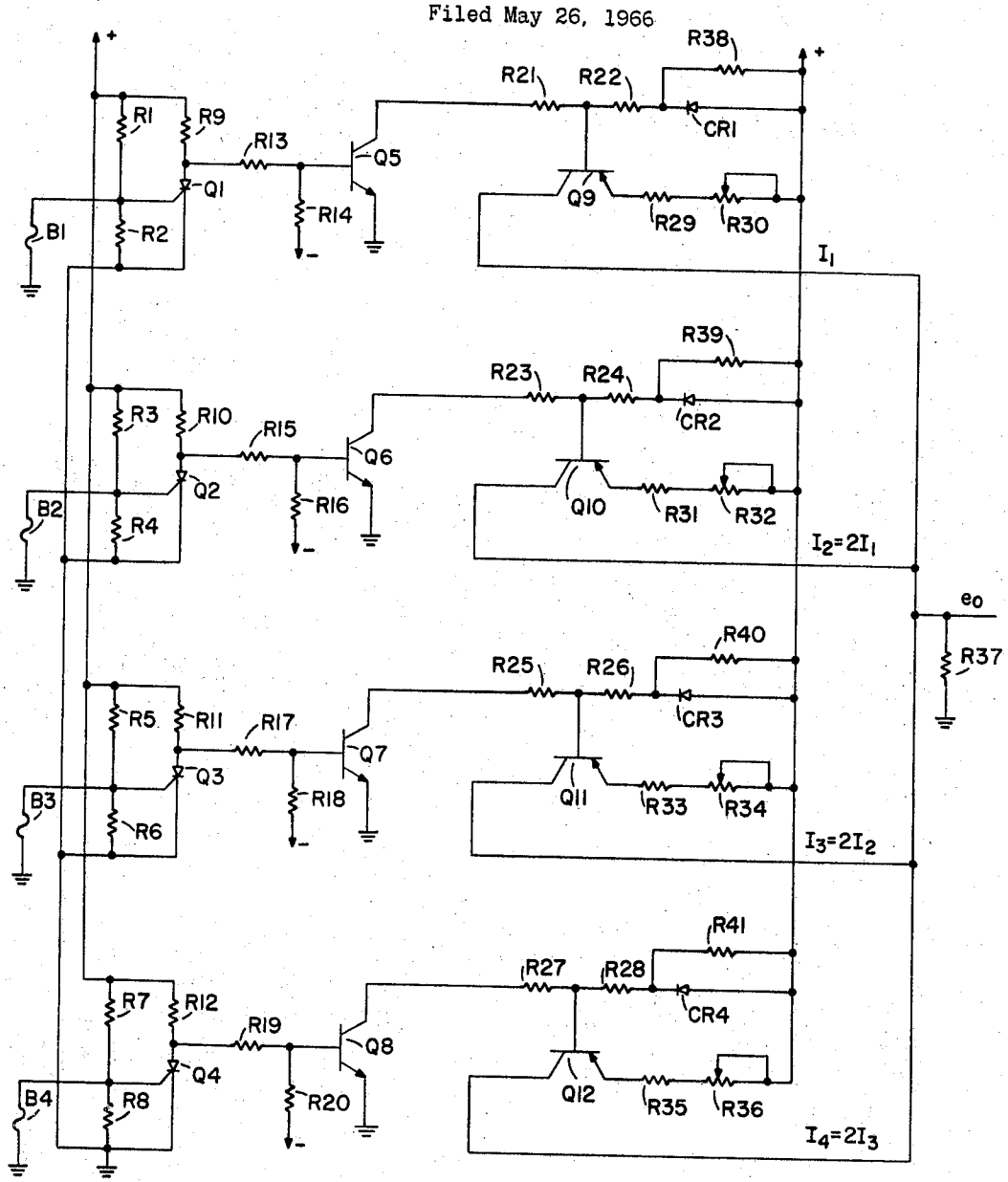
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BREAKWIRE SIGNAL CONDITIONER

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BREAKWIRE SIGNAL CONDITIONER

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ABSTRACT OF THE DISCLOSURE

A plurality of circuits wherein the breaking of a breakwire causes an SCR to turn on a current source. Each discrete current source is connected to a common resistor whereby the output may be analyzed to determine which breakwire or breakwires have broken.

This invention relates to a breakwire signal conditioner and relates particularly to a breakwire signal conditioner in which the phenomenon of four wires breaking is converted into an electrical signal.

A signal conditioner is needed which sums the mechanical phenomenon of four wires breaking and converts it into an electrical signal suitable as an input to a telemetry subcarrier oscillator (0–5 volts DC). This signal must indicate at all times the condition of each wire. With four breakwires, there are sixteen possible conditions. The device must give a discrete voltage level output for each condition.

There are presently breakwire signal conditioners in use which have overlapping voltage steps, depending on which combination of wires are broken. This is an undesirable characteristic if the breakwire signal conditioner is to be used with a telemetry system which must have a definite voltage gradient in exact steps. The prior art conditioner provides a chance of signal loss due to the broken breakwire shorting to ground and shorting out the instrumentation battery, thus losing the signal. In some applications where the prior art conditioner is used in missiles, the broken breakwire would short to the missile skin, thus shorting out the instrumentation battery.

It is, therefore, an object of this invention to provide a breakwire signal conditioner in which there are sixteen equal voltage steps, dependent upon the combination of breakwires broken.

It is, also, an object of this invention to provide a breakwire signal conditioner wherein said voltage steps are of such magnitude as to permit their use in the keying of a telemetry system.

Additionally, it is an object of this invention to provide a breakwire signal conditioner wherein the shorting of a broken breakwire to ground will have no effect on the output of said breakwire signal conditioner.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the single figure drawing which is a schematic diagram of the present invention.

Referring now to the drawing, this embodiment of the present invention comprises four similar channels, each channel consisting similiarly of a breakwire, a silicon controlled rectifier having its control gate connected to the breakwire, and a current source consisting of transistors connected thereto. The output of each channel's current source is parallel connected with output resistor R37.

In an effort to simplify the explanation and in an effort to make the invention more understandable to the reader, the explanation of the circuit operation will deal only with one of these channels. Initially, all four of the breakwires B1, B2, B3, and B4 are intact, and the four inputs are shorted to ground. This shorts the gates of silicon controlled rectifiers Q1, Q2, Q3, and Q4, respectively, to the cathodes, which holds them off. The breaking of any one of the four breakwires will produce a similar response from its channel.

Referring now to the first channel, when breakwire B1 breaks, the voltage divider composed of resistors R1 and R2 will turn silicon controlled rectifier Q1 on. After breakwire B1 is broken and silicon controlled rectifier Q1 is turned on, shorting of that particular input to ground will have no effect on the silicon controlled rectifier. The silicon controlled rectifier Q1 turns its associated current source, composed of transistors Q5 and Q9, on and off. When silicon controlled rectifier Q1 is off, a voltage is applied to the voltage divider composed of R13 and R14. This voltage will turn transistor Q5 on. The voltage divider composed of R21 and R22 supplies a fixed voltage to the base of transistor Q9, neglecting the voltage drop across diode CR1. The voltage drop across CR1 tends to cancel the drop across the base to emitter junction of transistor Q9 which make the voltage across the series combination of R29 and R30 be approximately equal to the voltage across R22. The voltage across diode CR1 and the base to emitter voltage of transistor Q9 track each other with temperature which tends to compensate for temperature changes. When silicon controlled rectifier Q1 is on, its anode voltage is approximately equal to zero volt. Therefore, the negative voltage appearing on the base of transistor Q5 will turn it off. The base voltage across transistor Q9 divided by the corresponding emitter resistance, resistors R29 and R30, gives the current supplied by this channel. Resistor R30 is variable so that the exact value of current desired may be tuned in.

Returning now to a discussion of the present invention in its entirety, the output voltage level, measured across R37, is one of sixteen dicrete voltage levels, equally spaced between 0 volt DC and 5 volts DC. Thus, each discrete voltage level is separated from its adjacent voltage levels by 0.333 volt DC. The exact voltage output is, of course, dependent upon which combination of breakwires are broken. To obtain the maximum spread, each channel's current output I_1, I_2, I_3, and I_4 is selected to be twice that of the preceding channel.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A breakwire signal conditioner comprising a plurality of breakwire channels and a resistor; each channel comprising: a switch means, a breakwire connected between a ground and said switch means for controlling said switch means, and a current source having a control terminal and a current output terminal, said switch means being connected to said control terminal of said current source and said resistor being connected between said output of said current source and ground; the output current of each current source differing from the output current of any other current source and the sum of any combination thereof differing from the sum of any other combination thereof.

2. A breakwire signal conditioner as set forth in claim 1 wherein each said switching means is a silicon controlled rectifier whose gate is connected to said breakwire.

3. A breakwire signal conditioner as set forth in claim 1 wherein each said current source comprises a first transistor having a base, emitter, and collector, said base being connected to each said switching means.

4. A breakwire signal conditioner as set forth in claim

3 wherein each said current source includes a second transistor having a base, emitter, and collector, said base of said second transistor being connected to said collector of said first transistor.

5. A breakwire signal conditioner as set forth in claim 1 wherein each said current source is a temperature compensated current source.

6. A breakwire signal conditioner as set forth in claim 1 to comprise at least a first, second, third, and fourth channel and wherein the current from said current source for each channel is exactly twice that of the preceding channel.

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