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DRIVER CIRCUIT WITH FEEDBACK CONTROL TO MAINTAIN CONSTANT VOLTAGE AT A COMMON ELECTRIC CONTACT MEMBER

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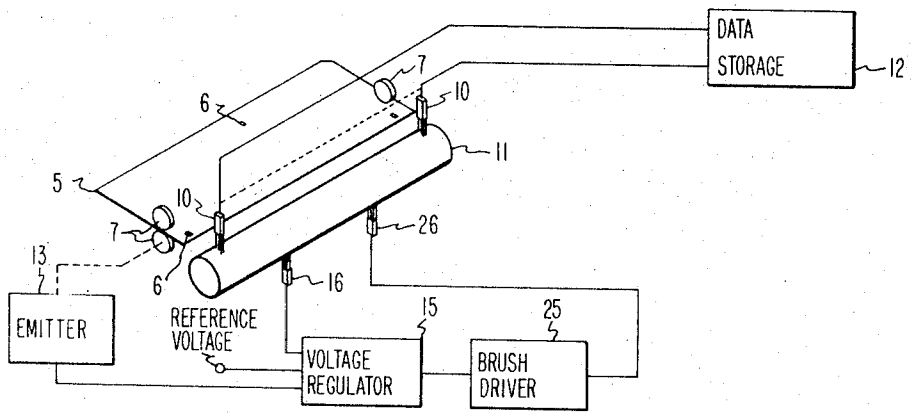

FIG. 1

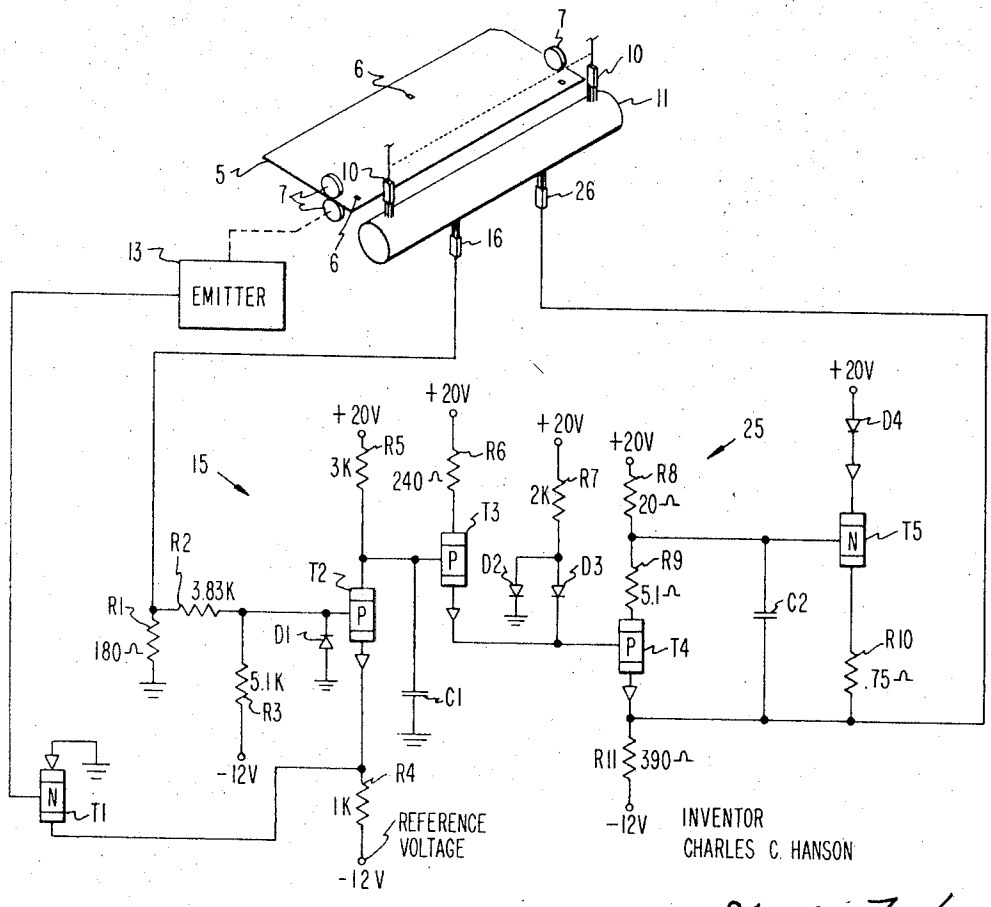

FIG. 2

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DRIVER CIRCUIT WITH FEEDBACK CONTROL TO MAINTAIN CONSTANT VOLTAGE AT A COMMON ELECTRIC CONTACT MEMBER

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5 Claims

ABSTRACT OF THE DISCLOSURE

An electrical circuit, with especial utility in a record reading device in which a perforated card is passed between a plurality of brushes and a common member, is disclosed. It maintains a substantially constant electric potential on the common member, regardless of the number of brushes which are conducting. The circuit has a feedback arrangement, which includes a potential sensing brush, constantly in contact with said member, a power source and a voltage regulator, responsive to this brush, to maintain a constant potential on said member. The circuit may be associated with an emitter used in the scanning circuit.

This invention relates to electrical driving circuits with feedback control and more particularly to circuits for driving a common member which provides electrical power to a plurality of selectively conducting devices whereby through a feedback sensing circuit, the electric potential at the common member is caused to remain substantially constant regardless of the number of devices conducting.

The invention finds particular utility in data reading machines where the data is represented in the form of perforations in a record member. In these machines, the perforations are sensed by reading brushes. The record members pass between a contact roll and a plurality of reading or sensing brushes. Normally, the record member holds the sensing brushes out of contact with the contact roll. However, a perforation permits the associated sensing brush to make electrical contact with the contact roll whereby a signal is generated to indicate that a bit of data has been sensed. The contact roll is energized by a driver circuit through a common brush which is in constant contact with the roll.

If variations in voltage drops across the contact roll and driver circuit exist, reading errors can occur, particularly where the signals representing the data must be stored in electronic data storage devices. The present invention maintains a desired potential on the contact roll. The voltage drops between the sensing brushes and the contact roll are relatively constant regardless of the number of brushes that are conducting. The voltage drop between the common brush and contact roll increases or decreases as the number of sensing brushes conducting increases or decreases. In this invention, the potential of the contact roll is sensed by an additional brush loaded by an impedance which simulates the normal brush load. This sensed potential is then fed back through a voltage regulating circuit to the brush driver circuit to force the desired potential on the contact roll through the common brush.

Accordingly, a principal object of this invention is to provide an improved electrical driving circuit with feedback control.

Another very important object of the invention is to provide an improved electrical driver circuit for driving a common member to provide electrical power to a plurality of selectively conducting devices which

includes means to sense the potential of the common member and force the desired potential on the common member regardless of the number of devices conducting.

Still another object of the invention is to provide an improved electrical driver circuit which is independent of positive power supply variations.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a schematic block diagram illustrating the invention as incorporated in a perforated record reading machine; and

FIG. 2 is a schematic circuit diagram of the voltage regulator and brush driver circuits of FIG. 1

With reference to the drawings, and particularly to FIG. 1, the invention is illustrated by way of example as being incorporated into a perforated record sensing machine. Only those elements of the perforated record sensing machine which are directly involved with the invention are shown. The perforations **6** in record card **5** are sensed as card **5** passes between sensing brushes **10** and contact roll **11**. The data sensed by brushes **10** is transferred to data storage **12** which may be internal or external to the machine. A Read signal is generated by emitter **13** for each row of sensing positions on the perforated record card **5**. The emitter **13** which is represented in block form can be any suitable magnetic, photoelectric or electrical contact emitter which is driven in synchronism with the movement of the card as it is being read. Card **5** is shown as being advanced by cooperating feed rolls **7**. The output of emitter **13** is connected to an input of voltage regulator circuit **15** which is thereby rendered active only during the time a row of sensing positions are being read. Voltage regulator circuit **15** also has an input from brush **16** positioned in contact with roll **11** for sensing the potential thereof. The output of voltage regulator **15** is connected to the input of brush driver **25** which provides the power to contact roll **11** through common brush **26**. If the contact roll potential as sensed by brush **16** decreases below a predetermined level, regulator circuit **15** causes brush driver **25** to increase the voltage at the common brush. Conversely, if the contact roll potential is higher than the desired level of potential, voltage regulator circuit **15** causes brush driver circuit **25** to reduce the voltage at the common brush **26**. By this arrangement, a substantially constant voltage at a desired potential is maintained on contact roll **11**.

The voltage regulator circuit is shown in detail in FIG. 2. The voltage at the contact roll **11** as sensed by brush **16** is applied to the base of transistor T2 via the voltage divider network formed by resistors R2 and R3. Resistor R1, which is connected in series with brush **16**, simulates the normal brush load. The emitter of transistor T2 is connected to −12 volts reference voltage through resistor R4 and is also connected to the collector of gating transistor T1. The collector of transistor T2 is connected to a +20 volts through resistor R5. The output from the voltage regulator circuit **15** is taken from the collector of transistor T2.

The base of gating transistor T1 is connected to receive Read pulses from emitter **13**. The emitter of transistor T1 is connected to ground. Transistor T1 is normally off and is rendered conductive by a Read pulse from emitter **13**. With transistor T1 off, transistor T2 is in a saturated condition and its collector is approximately at ground potential because its base is clamped to ground by diode D1. When transistor T1 is rendered con-

ductive, the current flowing through resistor R4 is divided between transistors T1 and T2 which effectively act as a differential amplifier to amplify the signal from brush **16** which is passed through the voltage divider formed by resistors R2 and R3. By this arrangement, if the voltage at the contact roll **11** as sensed by brush **16** decreases below the desired amount, which in this example is approximately ten volts, the base of T2 is driven less positive and therefore less current flows through resistor R5 and the output voltage from the collector of T2 increases. On the other hand, if the voltage at contact roll **11** increases above the desired level, i.e., above ten volts, the base of transistor T2 is driven more positively and more current flows through resistor R5. Consequently, the voltage at the collector of transistor T2 decreases. It should be recognized that an operational amplifier could be substituted for transistors T1 and T2 and associated circuitry without departing from the spirit of the invention.

The output of the voltage regulator circuit **15** which is taken from the collector of transistor T2 is applied to the base of transistor T3 of brush driver circuit **25**. Capacitor C1 is connected to the collector of transistor T2 and to the base of transistor T3 to control the frequency response and thereby prevent oscillation during the period that voltage regulator circuit **15** is operative, i.e., during the time that transistor T1 is conductive. Transistor T3 is an emitter follower and it drives the base of transistor T4. Transistor T4 forms a current amplifier with transistor T5. The common brush **26** is thus driven from the emitter of transistor T4 and the required current for brush **26** is provided by transistors T4 and T5.

The brush driver amplifier **25** is of the type well known in the art. Transistor T3 is driven harder when the output of voltage regulator **15** or the collector of transistor T2 rises. Thus, the emitter of transistor T3 follows this rise of voltage and a higher voltage is forced upon the contact roll **11** through the common brush **26** because the emitter of transistor T4 also rises. It also follows that if the output of voltage regulator **15** decreases as a result of a voltage level of contact roll **11** being above the desired amount, the voltage at the emitters of transistors T3 and T4 correspondingly decreases. A decrease in voltage is thereby forced via the common brush **26** at contact roll **11** to maintain the voltage at the desired level.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without department from the spirit and scope of the invention.

What is claimed is:

1. In a machine having a common brush, contact member and sensing brushes for sensing perforations in a record member the improvement which comprises:

sensing means for sensing the voltage of said contact member,

a voltage regulator circuit responsive to contact member voltage variations sensed by said sensing means to provide control signals, and

a driver circuit connected to receive said control signals and to drive said common brush at a voltage level controlled by said regulator circuit.

2. The improvement of claim **1** wherein said sensing means comprises:

an extra brush positioned in electrical contact with said contact member, and

an impedance connected to said extra brush to simulate the load on said sensing brushes.

3. The improvement of claim **1** wherein said voltage regulator circuit is active only during the time perforations are to be read.

4. The improvement of claim **1** wherein said voltage regulator circuit comprises a differential amplifier.

5. The improvement of claim **4** wherein said differential amplifier comprises:

a first transistor having an emitter connected to ground potential, a collector and adapted to be switched on by a signal applied to its base,

a reference potential,

a voltage divider connected between said sensing means and said reference potential,

a resistor connected to said reference potential, and

a second transistor having an emitter connected to said resistor and to the collector of said first transistor and a base connected to said voltage divider circuit so that a control voltage is developed at its collector when said first transistor is conducting.

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