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Albrecht et al.

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[54] CONTACTLESS PROGRAM MONITOR

[75] Inventors: **Adolf Albrecht; Ulrich von Borcke; Paul Hini; Hans Hieronymus,** all of Erlangen, Germany

[73] Assignee: **Siemens Aktiengesellschaft,** Berlin and Munich, Germany

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **338/32 R,** 200/46, 323/94 H, 335/1

[51] **Int. Cl.** **H01c 7/14**

[58] **Field of Search** ..... 338/32 R, 32 H; 323/94 H; 335/1; 200/6 BB, 67 G, 46

[56] **References Cited**

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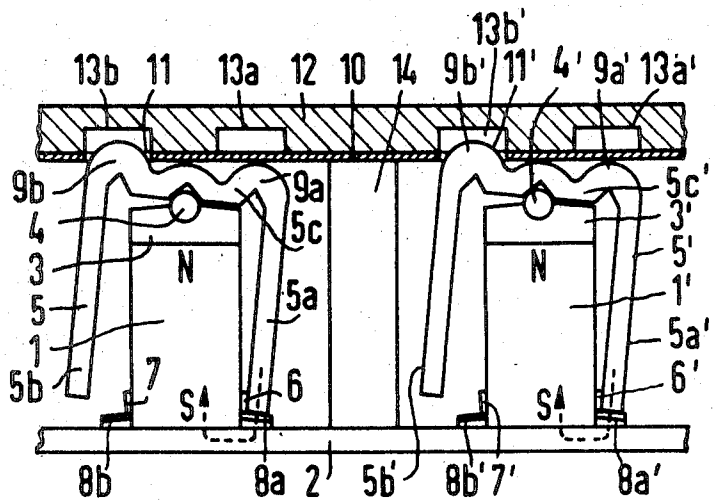
Primary Examiner—Samuel Feinberg
Assistant Examiner—R. Kinberg
Attorney—Curt M. Avery, Arthur E. Wilfond, Herbert L. Lerner and Daniel J. Tick

[57] **ABSTRACT**

A pole shoe is rigidly affixed to one pole of a magnet and a yoke is pivotally mounted on the other pole of the magnet about an axis. The yoke is of substantially inverted U-shaped configuration having a pair of spaced yoke legs joined at one end by a head portion pivotally mounted on the other pole of the magnet in a manner whereby the yoke is pivotable from one stable state to another in a plane formed by the yoke legs. Each of a pair of galvanomagnetic resistors is mounted on the pole shoe on a corresponding side of the magnet in a manner whereby when the yoke is in one stable state one yoke leg thereof is in close proximity with one of the galvanomagnetic resistors and the other yoke leg thereof is spaced from the other of the galvanomagnetic resistors and vice versa. A pair of spaced transmitter members movably mounted adjacent the head portion of the yoke for movement in the plane of the yoke legs controls the pivotal movement of the yoke into a selected one of its stable states.

3 Claims, 3 Drawing Figures



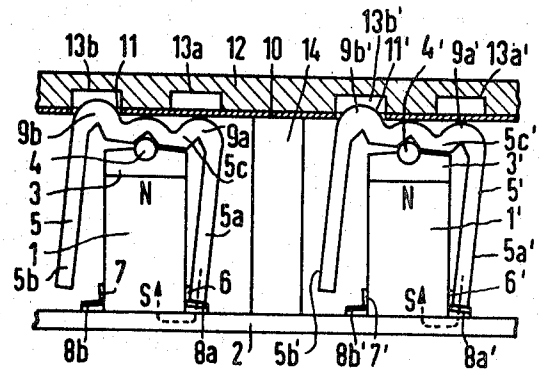


Fig. 1

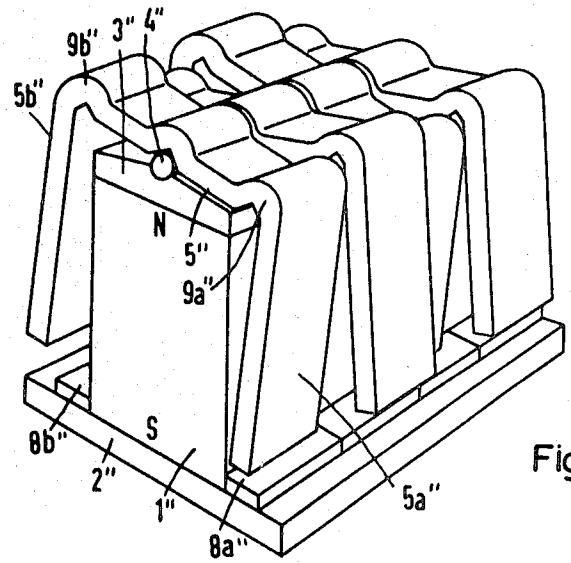


Fig. 2

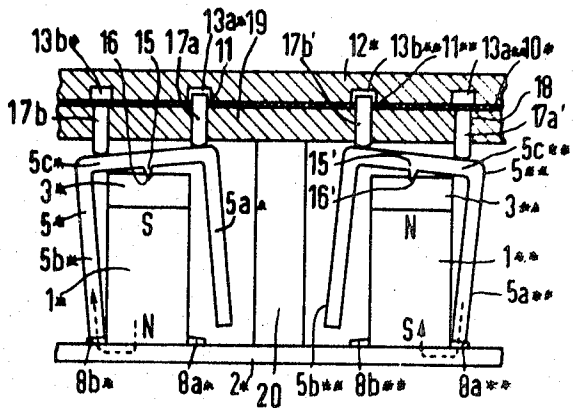


Fig. 3

CONTACTLESS PROGRAM MONITOR

DESCRIPTION OF THE INVENTION

The invention relates to a contactless program monitor. More particularly, the invention relates to a contactless program monitor having galvanomagnetic resistors which have resistance values which are varied by a magnet.

It is known to accommodate galvanomagnetic resistors, especially galvanomagnetic semiconductor resistors, in the air gap of a magnetic circuit and to produce variable resistances without contacts or potentiometers. This may be accomplished, for example, by varying the galvanomagnetic resistance, as described in U.S. Pat. No. 2,712,601. A device is electric contact-free when electrical contacts need not be operated in order to vary the resistance.

The resistance value of a galvanomagnetic resistor has a maximum when the resistor is located entirely in a magnetic field, that is, when the magnetic field is at its highest intensity. When the resistor is removed from the magnetic field, that is, when the magnetic field is reduced in intensity, the resistance value of the galvanomagnetic resistor may be reduced to a minimum. In the first instance, the galvanomagnetic resistor has a high resistivity, and in the second instance said resistor has a low resistivity. The galvanomagnetic resistance may be utilized to control a transistor, thyristor, or other controllable component. A monitor for single pulses, utilizing galvanomagnetic resistors, may function as a switch, together with the controllable structural component.

The principal object of the invention is to provide a new and improved contactless program monitor.

An object of the invention is to provide a contactless program monitor which is easy to program, without special preparations.

An object of the invention is to provide a contactless program monitor which is free from wear and corrosion and thus functions with high operating reliability.

An object of the invention is to provide a contactless program monitor which may be programmed without extensive or expensive preparations and functions with any desired programs due to the facility of preparation of a perforated card or strip which may be utilized to provide the program.

An object of the invention is to provide a contactless program monitor which may be constructed with considerable compactness and which may be supplied with a program via a perforated paper strip.

An object of the invention is to provide a contactless program monitor which may be programmed by a perforated paper strip reduced by a teleprinter.

An object of the invention is to provide a contactless program monitor which functions with efficiency, effectiveness and reliability.

In accordance with the invention, a contactless program monitor having galvanomagnetic resistors having variable resistance values controlled by at least one magnet comprises at least one magnet. Yoke means of soft magnetic material provided for the magnet comprises a pole shoe rigidly affixed to one pole of the magnet and a yoke pivotally mounted on the other pole of the magnet about an axis. The yoke is substantially inverted U-shaped configuration having a pair of spaced yoke legs joined at one end by a head portion pivotally

mounted on the other pole of the magnet in a manner whereby the yoke is pivotable from one stable state to another in a plane formed by the yoke legs. Each of a pair of galvanomagnetic resistors is mounted on the pole shoe of the yoke means on a corresponding side of the magnet in a manner whereby when the yoke of the yoke means is in one stable state one yoke leg thereof is in close proximity with one of the galvanomagnetic resistors and the other yoke leg thereof is spaced from the other of the galvanomagnetic resistors and when the yoke is in the other stable state the other yoke leg thereof is in close proximity with the other of the galvanomagnetic resistors and the one yoke leg thereof is spaced from the one of the galvanomagnetic resistors. A pair of spaced transmitter members cooperate with the head portion of the yoke of the yoke means for movement in the plane of the yoke legs for controlling the pivotal movement of the yoke into a selected one of its stable states.

Control means abutting the transmitter members controls the movement of the transmitter members thereby controlling the stable states of the yoke of the yoke means.

The magnet is a permanent magnet. Each of the galvanomagnetic resistors comprises indium antimonide having inclusions of nickel antimonide.

The transmitter members are movably mounted adjacent the head portion of the yoke and are positioned so that each is adjacent a corresponding end of the head portion of the yoke in a manner whereby when one of said transmitter members is moved in a specific direction it pivots the yoke into one of its stable states and when the other of the transmitter members is moved in the direction it pivots the yoke into the other of its stable states.

The transmitter members may be pins movably mounted in a guide member adjacent the head portion of the yoke and positioned so that each is adjacent a corresponding end of the head portion of the yoke in a manner whereby when one of the pins is moved in a specific direction it pivots the yoke into one of its stable states and when the other of the pins is moved in the direction it pivots the yoke into the other of its stable states.

The control means may comprise a perforated program card abutting the transmitter members and having a perforation for accommodating one of the transmitter members so that one of the transmitter members passes through the perforation and does not affect the yoke and the other of the transmitter members abuts the program card and is moved thereby in a specific direction into contact with the head portion of the yoke thereby pivoting the yoke into a selected one of its stable states.

The control means may comprise a perforated paper strip abutting the transmitter members and having a perforation for accommodating one of the transmitter members so that one of the transmitter members passes through the perforation and does not affect the yoke and the other of the transmitter members abuts the paper strip and is moved thereby in a specific direction into contact with the head portion of the yoke thereby pivoting the yoke into a selected one of its stable states.

The guide member comprises a guide plate having depressions formed therein for accommodating the

pins and the control means comprises a perforated member abutting the pins and interposed between the guide plate and the yoke means and having a perforation for accommodating one of the pins so that one of the pins passes through the perforation and does not affect the yoke and the other of the pins abuts the perforated member and is moved thereby in a specific direction into contact with the head portion of the yoke thereby pivoting the yoke into a selected one of its stable states.

Galvanomagnetic semiconductor resistors are known as field plates and are commercially available as such. They are therefore not described in detail herein.

In order that the invention may be readily carried into effect, it will now be described with reference to the accompanying drawing, wherein:

FIG. 1 is a schematic diagram, partly in section, of an embodiment of the program monitor of the invention;

FIG. 2 is a perspective view of another embodiment of the program monitor of the invention; and

FIG. 3 is a schematic diagram, partly in section, of another embodiment of the program monitor of the invention.

In the FIGS., the same components are identified by the same reference numerals.

In the embodiment of FIG. 1, a pair of magnets 1 and 1' are mounted, at corresponding poles thereof, on a carrier plate 2 of soft magnetic material. The portion of the plate 2 which extends away from the side of each of the magnets 1 and 1' is usually a pole leg of the magnet. The magnet has a pole shoe 3 at its pole opposite the one mounted on the carrier plate 2 and the magnet 1' has a pole shoe 3' at its pole opposite the one mounted on said carrier plate.

A yoke 5 is pivotally mounted on the pole shoe 3 of the magnet 1 and is pivotable about the axis of a pivot pin 4. A yoke 5' is pivotally mounted on the pole shoe 3' of the magnet 1' and is pivotable about the axis of a pivot pin 4'. Each of the yokes 5 and 5' is pivotable about its corresponding pivot pin 4 and 4' into a first stable state or a second stable state. The first stable state is determined by a stop 6 of the magnet 1 and by a stop 6' of the magnet 1'. The second stable state is determined by a stop 7 of the magnet 1 and a stop 7' of the magnet 1'.

The yoke 5 is of substantially U-shaped configuration having a pair of spaced yoke legs 5*a* and 5*b* joined at one end by a head portion 5*c* which is pivotally mounted on the pivot pin 4 in a manner whereby the yoke is pivotable from one stable state to another in a plane formed by the yoke legs. The yoke 5' is of substantially inverted U-shaped configuration having a pair of spaced yoke legs 5*a'* and 5*b'* joined at one end by a head portion 5*c'* pivotally mounted on the pivot pin 4' in a manner whereby the yoke is pivotable from one stable state to another in a plane formed by the yoke legs. The magnetic circuit of each of the yokes 1 and 1' is thus closed through its yoke legs.

A first galvanomagnetic resistor 8a is mounted on the pole shoe 2 at one side of the magnet 1 and a second galvanomagnetic resistor 8*b* is mounted on said pole shoe at the other side of said magnets. A first galvanomagnetic resistor 8*a'* is mounted on the pole shoe 2 at one side of the magnet 1' and a second galvanomagnetic resistor 8*b'* is mounted on said pole shoe at the other side of said magnetic. When the yokes 1 and 1' of FIG. 1 are in their stable states shown in the FIG., the magnetic flux of the magnetic circuit traverses the field plates 8*a* and 8*a'* via the yoke legs 5*a* and 5*a'*, respectively. The magnetic flux at the free yoke legs 5*b* and 5*b'* is negligible. Thus, in each stable state of each of the yokes 5 and 5', one of the field plates 8*a* and 8*b* or 8*b'* is subjected to a magnetic field. In FIG. 1, the magnetic flux, in the magnetic circuit, traversing the field plates 8*a* and 8*a'* is shown by broken line arrows.

The head portion 5*c* of the yoke 5 has a hump like projection 9*a* and 9*b* at each of its legs 5*a* and 5*b*, respectively. The head portion 5*c'* of the yoke 5' has a hump like projection 9*a'* and 9*b'* at each of its legs 5*a'* and 5*b'*, respectively. The humps 9*a* and 9*b* and 9*a'* function as transmitter members and are in the plane of their corresponding yoke legs. A program card 10 is provided. The program card 10 has perforations or holes 11 and 11' formed therethrough.

The perforation 11 is provided for the protrusion 9*b* of the head portion 5*c* of the yoke 5, so that said protrusion moves into said perforation and said yoke is pivoted to its first stable state. The perforation 11' is provided for the protrusion 9*b'* of the head portion 5*c'* of the yoke 5', so that said protrusion moves into said perforation and said yoke is pivoted to its first stable state. In its first stable state, each of the yokes 5 and 5', as shown in FIG. 1, has its yoke leg 5*a* and 5*a'*, respectively, in close proximity with the galvanomagnetic resistor 8*a* and 8*a'*, respectively.

The program card 10 is pressed against the program monitor, so that one of the projections 9*a* and 9*b* of the yoke 5 and one of the projections 9*a'* and 9*b'* of the yoke 5' protrudes through the corresponding perforation 11 and 11', respectively, of said perforated card. Actually, the program monitor is set in its stable state by the hump or protrusion which does not extend into a perforation of the program card 10. Thus, the projection 9*a* of the yoke 5 is urged downward by the program card 10 when said projection abuts said program card. The projection 9*a'* of the yoke 5' is urged downward by the program card 10 when said projection abuts said program card.

The program card 10 may comprise a planar plate and may consist of paper. The program card 10 is urged against the program monitor by a plate 12 having depressions 13*a*, 13*b*, 13*a'* and 13*b'* formed therein in the area of each of the protrusions 9*a*, 9*b*, 9*a'* and 9*b'*. The position of the program card 10 is determined by a spacer 14 which is positioned between the magnets 1 and 1' and is mounted on the carrier plate 2.

The program monitor of the invention is thus seen to be very compact in structure. The program card 10 may thus be a perforated strip and may comprise a perforated paper strip of the type utilized in teleprinting, for example. It is therefore very simple to produce the key for a desired program.

In the embodiment of FIG. 2, the perforated card, which is not shown in the FIG., in order maintain the clarity of illustration, may be removed, and the program monitor remains set in its stable state, even after the removal of said perforated card. The compact construction of the program monitor is illustrated by FIG. 2. In the embodiment of FIG. 2, a single magnet 1''

may be utilized as the control magnet for a plurality of yokes 5'', and so on.

In the embodiment of FIG. 3, the yoke 5* is pivotable about a pivot edge 15 formed in the head portion 5c* thereof and positioned in a groove 16 formed in the upper surface of the pole shoe 3* of the magnet 1*. The yoke 5** is pivotable about a pivot edge 15' formed in the head portion 5c** thereof and positioned in a groove 16' formed in the upper surface of the pole shoe 3** of the magnet 1**. The magnet 1* functions as the stop for determining the stable state of the yoke 5* and the magnet 1** functions as the stop for determining the stable state of the yoke 5**.

In the embodiment of FIG. 3, a pair of spaced transmitter members or pins 17a and 17b are movably mounted adjacent the head portion 5c* of the yoke 5* for movement in the plane of the yoke legs 5a* and 5b* for controlling the pivotal movement of the yoke into a selected one of its stable states. A pair of spaced transmitter members or pins 17a' and 17b' are movably mounted adjacent the head portion 5c** of the yoke 5** for movement in the plane of the yoke legs 5a** and 5b** for controlling the pivotal movement of the yoke into a selected one of its stable states.

Each of the pins 17a, 17b, 17a' and 17b' is movably mounted and guided in an aperture formed through a plate 19. The plate 19 is affixed to the carrier plate 2 by a spacer 20 and has a plurality of apertures, in which the corresponding pins are seated, formed therethrough. One of the apertures 18 is so labeled. The program monitor of the embodiment of FIG. 3 may be controlled in the aforedescribed manner by a perforated card or perforated strip 10 having perforations 11* and 11** therein to accommodate the transmitter member pins 17a and 17a', respectively.

In order to program the monitor, it must be determined which of the two field plates 8a* and 8b* and 8a** and 8b** of the yokes 5* and 5**, respectively, is positioned in a closed magnetic circuit, in accordance with the program. That is, it must be determined which of the two field plates of each of the yokes is to have a high ohmic resistance. In accordance with the desired program, the apertures 11* and 11** for accommodating the transmitter member pins 17a and 17b', respectively, may be produced in a perforated card 10* or may be punched in a perforated paper strip by a teleprinter. The program monitor of the invention may thus be utilized extensively for many control and regulating functions.

While the invention has been described by means of specific examples and in specific embodiments, we do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. A contactless program monitor having galvanomagnetic resistors having variable resistance values controlled by at least one magnet, said program monitor comprising at least one magnet; yoke means of soft magnetic material provided for said magnet, said yoke means comprising a pole shoe rigidly affixed to one pole of said magnet and a yoke pivotally mounted on the other pole of said magnet about an axis, said yoke being of substantially inverted U-shaped configuration having a pair of spaced yoke legs joined at one end by a head portion pivotally mounted on said other pole of said magnet in a manner whereby said yoke is pivotable from one stable state to another in a plane formed by said yoke legs; a pair of galvanomagnetic resistors each mounted on the pole shoe of said yoke means on a corresponding side of said magnet in a manner whereby when the yoke of said yoke means is in one stable state one yoke leg thereof is in close proximity with one of said galvanomagnetic resistors and the other yoke leg thereof is spaced from the other of said galvanomagnetic resistors and when said yoke is in the other stable state, the other yoke leg thereof is in close proximity with the other of said galvanomagnetic resistors and the one yoke leg thereof is spaced from the one of said galvanomagnetic resistors; a pair of spaced transmitter members cooperating with the head portion of the yoke of said yoke means for movement in the plane of said yoke legs for controlling the pivotal movement of said yoke into a selected one of its stable states; control means abutting said transmitter members for controlling the movement of said transmitter members thereby controlling the stable states of the yoke of said yoke means, said control means comprising a perforated program card abutting said transmitter members and having a perforation for accommodating one of said transmitter members so that one of said transmitter members passes through said perforation and does not affect said yoke and the other of said transmitter members abuts said program card and is moved thereby in a specific direction into contact with the head portion of said yoke thereby pivoting said yoke into a selected one of its stable states.

2. A contactless program monitor having galvanomagnetic resistors having variable resistance values controlled by at least one magnet, said program monitor comprising at least one magnet; yoke means of soft magnetic material provided for said magnet, said yoke means comprising a pole shoe rigidly affixed to one pole of said magnet and a yoke pivotally mounted on the other pole of said magnet about an axis, said yoke being of substantially inverted U-shaped configuration having a pair of spaced yoke legs joined at one end by a head portion pivotally mounted on said other pole of said magnet in a manner whereby said yoke is pivotable from one stable state to another in a plane formed by said yoke legs; a pair of galvanomagnetic resistors each mounted on the pole shoe of said yoke means on a corresponding side of said magnet in a manner whereby when the yoke of said yoke means is in one stable state, one yoke leg thereof is in close proximity with one of said galvanomagnetic resistors and the other yoke leg thereof is spaced from the other of said galvanomagnetic resistors and when said yoke is in the other stable state, the other yoke leg thereof is in close proximity with the other of said galvanomagnetic resistors and the one yoke leg thereof is spaced from the one of said galvanomagnetic resistors; a pair of spaced transmitter members cooperating with the head portion of the yoke of said yoke means for movement in the plane of said yoke legs for controlling the pivotal movement of said yoke into a selected one of its stable states; control means abutting said transmitter members for controlling the movement of said transmitter members thereby controlling the stable states of the yoke of said yoke means; said control means compris-

ing a perforated paper strip abutting said transmitter members and having a perforation for accommodating one of said transmitter members so that one of said transmitter members passes through said perforation and does not affect said yoke and the other of said transmitter members abuts said paper strip and is moved thereby in a specific direction into contact with the head portion of said yoke thereby pivoting said yoke into a selected one of its stable states.

3. A contactless program monitor having galvanomagnetic resistors having variable resistance values controlled by at least one magnet, said program monitor comprising at least one magnet; yoke means of soft magnetic material provided for said magnet, said yoke means comprising a pole shoe rigidly affixed to one pole of said magnet and a yoke pivotally mounted on the other pole of said magnet about an axis, said yoke being of substantially inverted U-shaped configuration having a pair of spaced yoke legs joined at one end by a head portion pivotally mounted on said other pole of said magnet in a manner whereby said yoke is pivotable from one stable state to another in a plane formed by said yoke legs, the head portion being pivotally mounted at its center at the center of the other pole of the magnet so that the yoke is symmetrical to the magnet; a pair of galvanomagnetic resistors each mounted on the pole shoe of said yoke means on a corresponding side of said magnet in a manner whereby when the yoke of said yoke means is in one stable state, one yoke leg thereof is in close proximity with one of said galvanomagnetic resistors and the other yoke leg thereof is spaced from the other of said galvanomagnetic resistors and when said yoke is in the other stable state, the other yoke leg thereof is in close proximity with the other of said galvanomagnetic resistors and the one yoke leg thereof is spaced from the one of said galvanomagnetic resistors; a pair of spaced transmitter members cooperating with the head portion of the yoke of said yoke means for movement in the plane of said yoke legs for controlling the pivotal movement of said yoke into a selected one of its stable states; control means abutting said transmitter members for controlling the movement of said transmitter members thereby controlling the stable states of the yoke of said yoke means; the transmitter members being pins movably mounted in a guide member adjacent the head portion of said yoke and positioned so that each is adjacent a corresponding end of the head portion of said yoke in a manner whereby when one of said pins is moved in a specific direction, it pivots said yoke into one of its stable states and when the other of said pins is moved in said direction, it pivots said yoke into the other of its stable states; said guide member comprising a guide plate having depressions formed therein for accomoodating said pins, and said control means comprising a perforated member abutting said pins and interposed between said guide plate and said yoke means and having a perforation for accommodating one of said pins so that one of said pins passes through said perforation and does not affect said yoke, and the other of said pins abuts said perforated member and is moved thereby in a specific direction into contact with the head portion of said yoke thereby pivoting said yoke into a selected one of its stable states.

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