

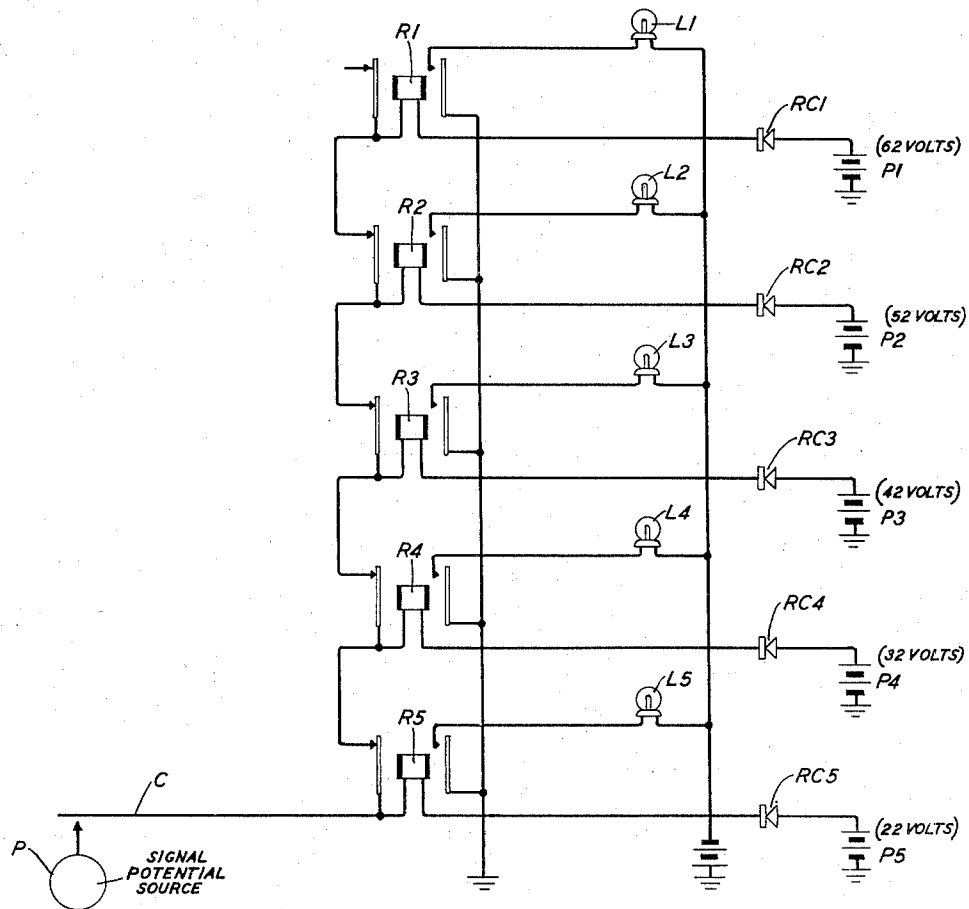
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RELAY SELECTING AND INDICATING CIRCUIT

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RELAY SELECTING AND INDICATING  
CIRCUIT

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This invention relates to electrical selecting circuits.

The selection and actuation of one of a number of electrical elements in accordance with an electrical signal characteristic of the element to be selected is an operation required in many electrical systems. A wide variety of circuits have been designed and are in common use for this purpose. The commonest form of such circuits is, perhaps, that which employs electromechanical switches. Relay circuits present advantages over those employing electromechanical switches in greater simplicity and reliability, minimum wear, and reduced maintenance. These advantages are offset to some extent, however, in many circuits of this kind by the necessity of using a large number of relays, a complicated circuit arrangement, and several different types of relay construction.

The present invention discloses a novel and an unusually simple and inexpensive form of circuit for selecting purposes, which may also be used as an indicating circuit.

A feature of the invention is that only one relay is required for each element to be selected.

Another feature of the invention is that all of the relays employed may be exactly alike both in their construction and in their electrical characteristics. Rectifiers are employed in connection with the relays and these may also be identical.

Still another feature of the invention is that the signals are merely different electrical potentials and may all be of the same polarity.

Still another feature of the invention is that the signals are applied to a single conductor.

The features of the invention, its construction, and its mode of operation will be apparent from the accompanying description, the appended claims, and the drawing, which shows an embodiment of the invention arranged to perform selections and to give signal indications.

In the drawing, the electrical elements to be selected and actuated are represented by the lamps L1 . . . L5. These are shown by way of illustration only, as it will be apparent that the invention may be applied to the selection and actuation of any other suitable elements. One of the relays R1 . . . R5 is provided for each of the lamps L1 . . . L5. Each of said relays has a pair of control contacts (at the right) for actuating the associated lamp or other selected element, and a pair of selection contacts (at the left) to which one end of the relay winding is connected. The relays are, therefore, very simple, having but one winding and two pairs of make contacts each. The other end of the winding of

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each of the relays is connected to one pole of one of the rectifiers RC1 . . . RC5, respectively. These rectifiers may be any suitable form of such devices, having a high resistance to the passage of current in one direction and a low resistance to the passage of current in the other direction, and may be all exactly alike. The other pole of each rectifier is supplied with an appropriate potential, as hereinafter described, from any suitable source. The selection contacts of all the relays are interconnected as shown so that one end of each relay winding is normally connected to the single control conductor C.

As indicated in the drawing, all of the relays R1 . . . R5 have the same form. They may be identical. In the present embodiment of the invention, they all have substantially the same electrical characteristics. The potentials which should be connected to the rectifiers RC1 . . . RC5 will depend upon the poling of said rectifiers and the electrical characteristics of the relays R1 . . . R5. In the present embodiment of the invention, the rectifiers are poled to offer a high resistance to the passage of current from the relay windings through the rectifiers and the potentials supplied to the rectifiers should be positive as indicated. Each of the rectifiers RC1 . . . RC5 should then be supplied with a different positive potential. It is assumed, for the purpose of illustration in the present example, that each of the relays R1 . . . R5 will operate its contacts when a current of 0.1 ampere flows through its winding and will not operate on a substantially lower current. It is also assumed, by way of illustration, that the resistance of each relay winding is 100 ohms. Suitable positive potentials connected to rectifiers RC1 . . . RC5 are, in this case, 62 volts to rectifier RC1, 52 volts to rectifier RC2, 42 volts to rectifier RC3, 32 volts to rectifier RC4, and 22 volts to rectifier RC5, as indicated on the drawing. These potentials may be supplied from any suitable sources P1 . . . P5, or a single potential source may be used with a voltage divider or other suitable means of obtaining the required potentials for each of the rectifiers.

The rectifiers RC1 . . . RC5 may be of any suitable type, for example the metallic oxide type. In the present embodiment of the invention it is assumed, by way of example, that each of said rectifiers has a resistance in the low-resistance direction of less than 10 ohms and a resistance in the high-resistance direction of at least 10,000 ohms, such values being readily obtained in commercial forms of rectifiers.

In the normal condition of the circuit, none of

the relays R1 . . . R5 is operated, the current flow through the relay windings being, in each case, too low to cause operation of the relay. For example, current flows from source P1 through rectifier RC1 and the winding of relay R1, thence through four parallel circuits as follows: through left-hand contacts and winding of relay R2 and rectifier RC2 to source P2; through left-hand contacts and winding of relay R3 and rectifier RC3 to source P3; through left-hand contacts and winding of relay R4 and rectifier RC4 to source P4; and through left-hand contacts and winding of relay R5 and rectifier RC5 to source P5. The difference of potential between source P1 and source P5 is, in the present example, 40 volts, and this potential difference causes a current flow through rectifier RC5 in its high-resistance direction. The resistance of said rectifier in this direction being not less than 10,000 ohms, said current flow cannot exceed 0.008 ampere. The potential difference between source P1 and sources P2, P3 and P4 is, in each case, less than 40 volts and the current flow in each of the other three branches of the circuit traced above is, consequently, less than 0.008 ampere. The total current flow through the winding of relay R1 cannot, therefore, equal 0.032 ampere, which is too small to operate said relay. Similarly, current flows from sources P1, P2, P3 and P4 through their respective rectifiers and relays, contacts and winding of relay R5, and rectifier RC5, in the high-resistance direction, to source P5. The maximum potential difference between any of the sources P1, P2, P3 and P4 and source P5 being 40 volts and the resistance of rectifier RC5 in the high-resistance direction being not less than 10,000 ohms, the current through the winding of relay R5 cannot equal 0.032 ampere, which is insufficient to operate said relay. It is apparent that similar conditions hold for relays R2, R3 and R4 and that none of said relays are operated.

Now, if a signal potential of 10 volts is applied from any suitable signal potential source P to conductor C, current will flow from the higher potential source P5 through rectifier RC5, the winding of relay R5, and conductor C to the lower potential source P. This current, flowing through rectifier RC5 in the low-resistance direction, will amount to 0.2 ampere and the total current flowing through the winding of relay R5 is at least 0.1 ampere. Said relay, therefore, operates, and its left-hand contacts open the circuit from conductor C to relays R1, R2, R3 and R4, preventing the operation of any of said latter relays. The right-hand contacts of relay R5 close an obvious circuit for lamp L5. The resultant lighting of said lamp indicates the particular signal (10 volts) which was applied to conductor C. In response to said signal lamp L5 has been selected and actuated.

If, instead of 10 volts, a signal potential of 20 volts be applied to conductor C from the signal potential source P, current will flow from the higher potential source P5 through rectifier RC5, the winding of relay R5, and conductor C to the lower potential source P. The potential difference between source P5 and source P being but 2 volts, however, the resultant current through the winding of relay R5 cannot exceed 0.02 ampere, which is of the same order of magnitude as the opposing current, described above, which normally flows through said winding. Relay R5 is not, therefore, operated. Current also flows from source P4 through rectifier RC4, the winding of

relay R4, left-hand contacts of relay R5, and conductor C to the lower potential source P. This current flows in the low-resistance direction of rectifier RC4, and, the potential difference between source P4 and source P being 12 volts, the current in the winding of relay R4 is at least 0.1 ampere, which is sufficient to operate relay R4. Said relay thereupon operates and its left-hand contacts open the circuit from conductor C to relays R1, R2 and R3, preventing the operation of said latter relays. The right-hand contacts of relay R4 close an obvious circuit for lamp L4, which is thereby selected and actuated. The lighting of said lamp also indicates the particular signal (20 volts) applied to said conductor.

It is not believed necessary to describe in detail how, in a similar manner, a signal of 30 volts applied to conductor C causes the operation of relay R3 and the selection and actuation of lamp L3, a signal of 40 volts causes the operation of relay R2 and the selection and actuation of lamp L2, and a signal of 50 volts causes the operation of relay R1 and the selection and actuation of lamp L1. The operation in each case will be apparent from the descriptions already given. Furthermore, although five elements to be selected and actuated (lamps L1 . . . L5) are shown in the present embodiment of the invention, the circuit may evidently be extended to select and actuate other numbers of selectable elements in response to appropriate signal potentials. The different signal potentials may be successively applied to conductor C by any suitable means and in any order desired.

It will also be understood that the specific values of resistances and potentials used in the present example of the invention are given by way of illustration only and that other suitable values may equally well be used. The poling of the rectifiers RC1 . . . RC5 may be reversed and negative potentials employed instead of positive potentials. Also, while it is advantageous that all of relays R1 . . . R5 be alike, it is not essential that they be, as any suitable relays may be employed and compensation for differences in the characteristics of the relays may readily be made by suitable adjustment of the individual potential values. The same is true of the rectifiers RC1 . . . RC5 which may be all alike or may differ one from the other. Other adaptations and modifications within the scope of the invention will be apparent to those skilled in the art.

The terms and expressions which I have employed in reference to this invention and its elements are used as terms of description and not of limitation, and I have no intention in the use of such terms and expressions of excluding thereby equivalents of the features shown and described or portions thereof but, on the contrary, intend to include therein any and all equivalents and modifications which may be employed without departing from the spirit of the invention.

What is claimed is:

1. An electrical selecting circuit comprising in combination a plurality of relays to be energized, each of said relays having a pair of normally closed contacts, a rectifier and a source of different biasing potential for each relay connected serially with the winding of said relay and differentially with the windings of all other relays through the contacts of said relay and the contacts of said other relays, means for producing an equal number of different signal potentials, and means for applying said signal potentials

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successively to all of said relays whereby a different relay is energized for each signal potential.

2. An electrical selecting circuit as set forth in claim 1 in which all of said relays are substantially alike in respect to their electrical characteristics and alike in respect to their contacts, and all of said rectifiers are substantially alike in respect to their electrical characteristics.

3. An electrical indicating circuit comprising in combination with a plurality of relays, each of said relays including a winding and a pair of normally made contacts, means for producing a different signal potential for each of said relays, a rectifier and a source of different biasing potential for each of said relays, the winding of each of said relays, rectifier and source of different biasing potential therefor forming a serial path with said means for producing a different signal potential, each serial path being joined differentially to other similar paths through the contacts of one of said relays and the contacts of all other of said relays, means for applying

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one of said signal potentials to all of said relays, thereby to operate the one of said relays to which said applied signal potential appertains, and means responsive to the operation of said relay for indicating the signal potential so applied.

4. An electrical indicating circuit as set forth in claim 3 in which all of said relays are substantially alike in respect to their electrical characteristics and alike in respect to their contacts, and all of said rectifiers are substantially alike in respect to their electrical characteristics.

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