Jan. 21, 1969 R. WILLIAMS 3,423,745

INDICATOR LAMP CONTROL CIRCUIT

Filed May 13, 1965

FIG. 1

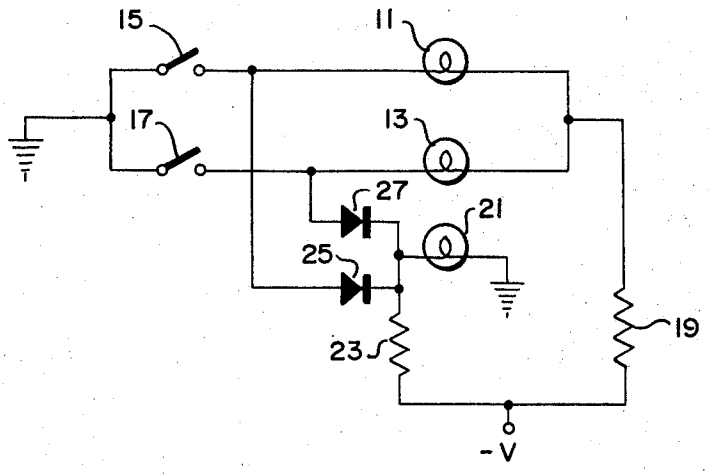


FIG. 2

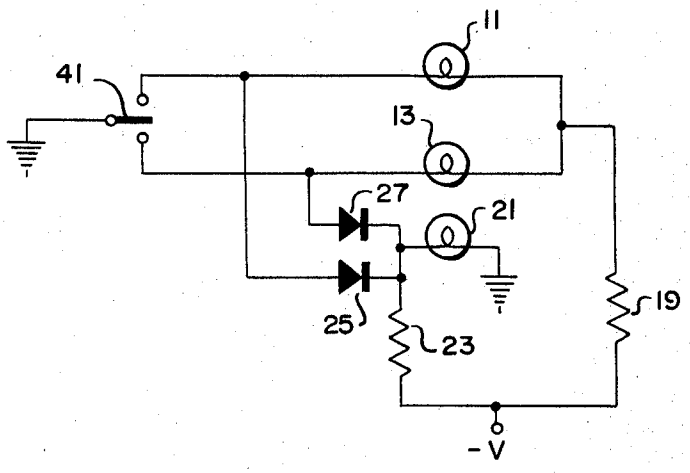
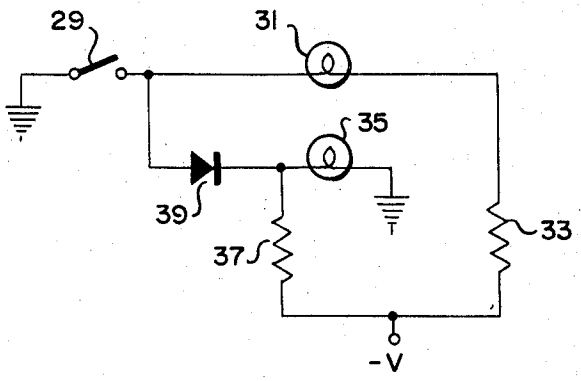


FIG. 3



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INDICATOR LAMP CONTROL CIRCUIT

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ABSTRACT OF THE DISCLOSURE

A control circuit for indicating devices which controls the operation of a plurality of parallel connected indicator lamps, each connected in series with selectively operable switches, and a separate normally lighted lamp. All of the lamps are coupled for energization to a single voltage supply. Diode means separately couple the switches to the normally lighted lamp for extinguishing it when any one or more of the parallel connected lamps is lighted.

This invention relates generally to control circuits for indicator lamps and more particularly to circuits for controlling the individual actuation of a plurality of indicating lamps with a lesser number of switches.

The keyboard input to accounting and data processing machines is usually divided into a numerical section and a typewriter section. The numerical section of the keyboard has a plurality of number keys arranged in rows and columns thereon. All the keys in a row are of the same value, and the value of the rows is graduated from 0 to 9. Control keys which determine the operation to be performed with the quantities inserted in the number keys are set to the side of the keyboard.

The order of magnitude of the number inserted into the machine by way of the keyboard is determined by the location of the decimal point. In many machines its position is indicated by decimal indicator lamps set between each two columns. In order that the machine will be able to handle a wide range of numbers, the decimal point is movable from column to column but, of course, only one lamp may be on at a time.

Some previous circuits used to control lamps of this type have required the use of double-pole, single-throw switches and a plurality of equal, independent voltage sources. The circuitry involved is fairly complicated and, because of space and design requirements, impractical in many operations. Other circuits have used solenoid actuated switches having separate sets of contacts for each lamp. These circuits again have the same disadvantages of requiring relatively large amounts of space and complicated circuitry.

It is, therefore, an object of my invention to simplify the circuitry required to control decimal indicating lamps.

A further object of my invention is to provide a control circuit for indicating lamps using a single voltage supply.

A further object of my invention is to provide a circuit for controlling a plurality of indicating lamps using a lesser number of switches in conjunction with a single voltage supply.

In carrying out these and other objects of my invention, I provide a plurality of parallel connected lamps, each connected in series with selectively operable switches, and a separate normally lighted lamp. All of the lamps are coupled for energization to a single voltage supply. Diode means separately couple the selectively operable switches to the normally lighted lamp for extinguishing it when any of the parallel connected lamps is lighted.

Various other objects, advantages and features of my invention will become more fully apparent from the following specification with its appended claims and accompanying drawings in which:

FIG. 1 is a schematic diagram of a 3-lamp circuit embodying my invention.

FIG. 2 shows a modified 3-lamp circuit embodying my invention.

FIG. 3 is a schematic diagram of a 2-lamp circuit embodying my invention.

My invention can best be understood by referring to the following detailed description of the illustrated embodiments.

Referring to FIG. 1 of the drawings, which illustrates the preferred embodiment of my invention, lamps **11** and **13** are connected in series with normally open single-pole, single-throw switches **15** and **17**, respectively. The other terminals of the switches are connected to a point of reference potential such as ground. The other sides of the lamps are connected to voltage source —V through resistor **19**. One terminal of lamp **21** is connected to a point of reference potential and the other is connected to voltage source —V through impedance **23**. The junction of lamp **21** and impedance **23** is connected to the junction of switch **15** and lamp **11** through diode **25** and to the junction of switch **17** and lamp **13** through diode **27**. These diodes are poled so as to clamp the junction of impedance **23** and lamp **21** at or above the reference potential when either of the switches **15** or **17** is closed.

When both switches are open, lamps **11** and **13** are open circuited and are thus extinguished. Lamp **21** is actuated by current from voltage source —V through resistor **23**. When either of the switches **15** or **17** is closed, the lamp with which it is in series, **11** or **13**, is lighted by current from voltage source —V through resistor **19**. The closing of this switch also connects the anode of the diode **25** or **27**, respectively, to ground. This clamps the junction of lamp **21** and resistor **23** at ground potential and thereby extinguishes lamp **21** since both its terminals are grounded.

Other types of switches could be used in the 3-lamp embodiment of my invention illustrated in FIG. 1. FIG. 2 illustrates another embodiment of my invention showing the use of a single-pole, double-throw switch **41** in a 3-lamp embodiment of my invention. This circuit operates in exactly the same manner as the circuit in FIG. 1 and corresponding components in the two figures are numbered similarly.

It is also apparent that electronic switching means, such as transistors, may be used if desired in place of the mechanically operated switches illustrated in the drawings.

The circuit shown in FIG. 3 of the drawings is similar to that of FIG. 1 except that it has only one series-connected lamp-switch combination. Switch **29** and lamp **31** are connected in series. The other terminal of switch **29** is grounded and the other end of lamp **31** is connected to voltage source —V through resistor **33**. Lamp **35** and resistor **37** are connected in series between ground and voltage source —V. Diode **39** connects the junction of switch **29** and lamp **31** to the junction of lamp **35** and resistor **37**.

The circuit operates in the same manner as that shown in FIG. 1. When switch **29** is open, lamp **31** is off and lamp **35** is lighted. When switch **29** is closed, the junction of resistor **37** and lamp **35** is clamped to ground, extinguishing lamp **35**. The closing of switch **29** also completes the circuit of lamp **31** and causes it to light.

The two-lamp embodiment of my invention shown in FIG. 3 is particularly useful in binary indicating circuits. A "0" is represented by one configuration of the lamps and a "1" by the opposite configuration.

It is obvious that any number of series combinations of switches and lamps may be connected in parallel with the two already present in FIG. 1. The junction of the switch and lamp of each is connected to the junction of the resistor **23** and lamp **21** through a diode in the same manner as the two combinations present. As long as all the switches are open, lamp **21** is lighted. However, i

any of the switches are closed, lamp **21** is extinguished and the lamp in series with the closed switch lights. It would also be possible to close a number of switches at the same time, thereby lighting the lamps in series with the closed switches and extinguishing lamp **21**.

It is to be understood that the foregoing description is by way of illustration only and, as would be obvious to one skilled in the art, my invention can find many uses in environments other than business machines. It is also obvious that other indicating means, visual or audible, could equally well be used in place of the lamps shown in the drawings.

I claim:

1. An indicating circuit comprising

a plurality of two-terminal electrical indicating means, switch means connected between one terminal of each of all but one of said indicating means and a point of reference potential,

impedance means connecting one terminal of said one indicating means to said reference potential,

means for connecting the other terminal of all of said indicating means to a voltage source, and

unidirectional current conducting means for clamping the junction of said impedance means and said one indicating means to said reference potential when at least one of said indicating means is connected to said point of reference potential by said switch means.

2. The device of claim **1** wherein said indicating means comprise indicating lamps and said switch means comprise normally open single-pole, single-throw switches.

3. The device of claim **2** wherein said unidirectional current conducting means comprise semiconductor diodes individually connecting the lamp-connected terminals of the switches to the junction of said impedance means and said one lamp.

4. The device of claim **1** comprising three indicating means and wherein said switch means is a single-pole, double-throw switch.

5. A control circuit for a plurality of indicating lamps comprising

normally open single-pole, single-throw switches respectively in series with all but one of said lamps, the other end of said lamps being coupled to a source of voltage and the other end of said switches being connected to a point of reference potential,

resistive means in series with said one of said lamps, said one lamp and resistive means being connected between a point of reference potential and said source of voltage, and

diode means coupling the lamp-connected terminal of said switches to the junction of said one lamp and said resistive means for clamping said junction of said one lamp and said resistive means to said reference potential when any of said switches is closed.

6. A control circuit for a plurality of indicating lamps comprising

switches connected to all but one of said lamps,

continuously acting energizing means connected across said lamps and switches,

resistive means connected in series with said one lamp, said energizing means being also connected across said resistive means and said one lamp, and

diode means for extinguishing said one lamp when one or more of said switches are closed.

7. The device of claim **6** wherein said switches comprise normally open single-pole, single-throw switches connected in series with each of said lamps.

8. An indicating circuit comprising

two indicating lamps,

a single-pole, single-throw switch in series with one of said lamps,

impedance means connected in series with the other of said lamps,

continually acting energizing means for said series combinations, and

diode means connected to the junction of said impedance means and said other lamp for extinguishing said other lamp when said switch is closed.

9. An indicating circuit comprising

a plurality of parallel connected electrical indicating means, selectively operable switching means in series with each of said parallel connected indicating means,

separate normally activated electrical indicating means, and

unidirectional current conducting means separately coupling said parallel connected indicating means to said normally activated indicating means for de-energizing said normally activated indicating means when any of said selectively operable indicating means is activated.

10. An indicating circuit comprising

a single-pole, double-throw switch,

two indicating lamps connected between an energizing source and the outer terminals of said switch, the wiper of said switch being connected to a point of reference potential,

a third lamp, said third lamp being normally lighted from said energizing source, and

diode means separately coupling said first two lamps to said third lamp for extinguishing said third lamp when either of said first two lamps is lighted.

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