July 5, 1966 M. KRAWITZ 3,259,794

ELECTROLUMINESCENT-PHOTOCONDUCTIVE TRIGGERING DEVICE

Filed July 15, 1963 3 Sheets-Sheet 1

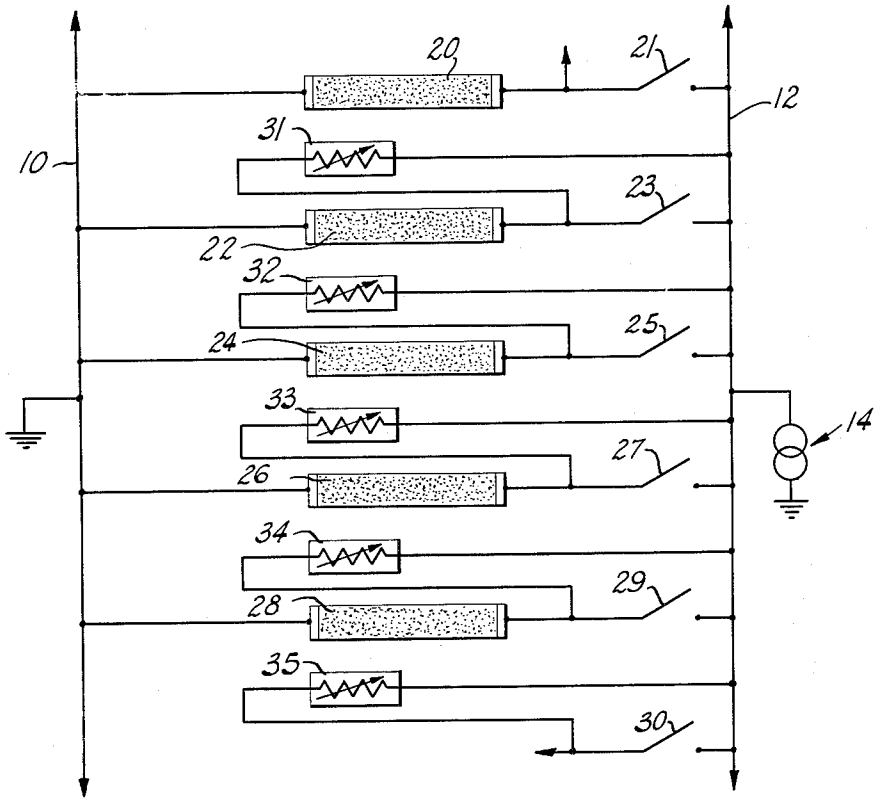


Fig. 1
Prior Art

INVENTOR
Max Krawitz
BY
Robert C. Strauss
ATTORNEY

July 5, 1966 M. KRAWITZ 3,259,794

ELECTROLUMINESCENT-PHOTOCONDUCTIVE TRIGGERING DEVICE

Filed July 15, 1963 3 Sheets-Sheet 2

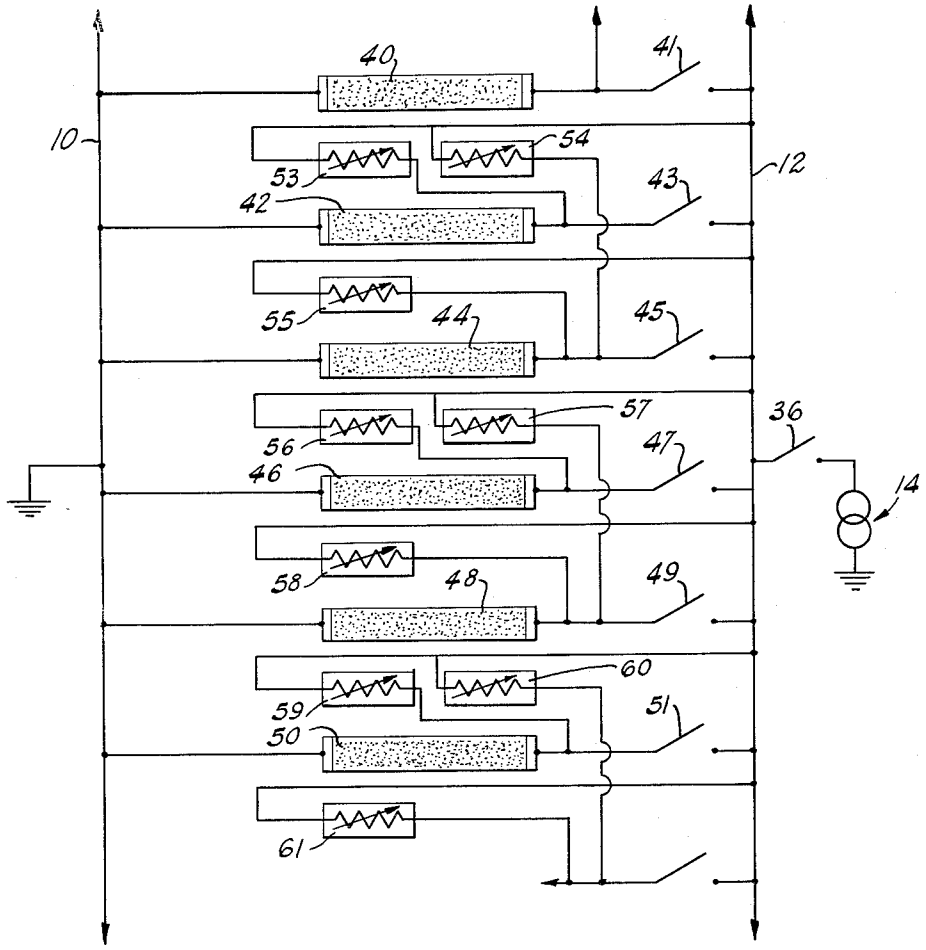


Fig. 2

INVENTOR
Max Krawitz
BY
Robert C. Stramar
ATTORNEY

July 5, 1966 M. KRAWITZ 3,259,794

ELECTROLUMINESCENT-PHOTOCONDUCTIVE TRIGGERING DEVICE

Filed July 15, 1963 3 Sheets-Sheet 3

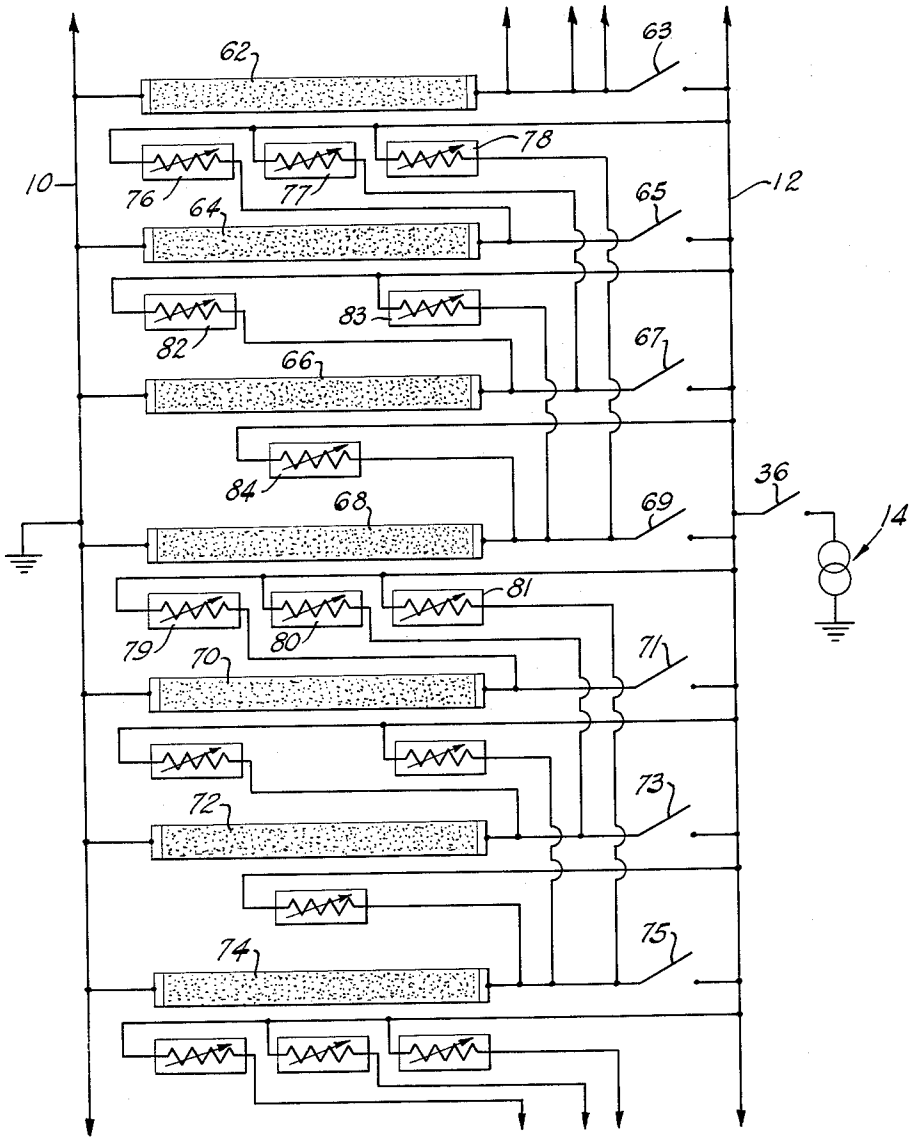


Fig. 3

INVENTOR
Max Krawitz
BY
Robert C. Strauser
ATTORNEY

United States Patent Office 3,259,794
Patented July 5, 1966

3,259,794

ELECTROLUMINESCENT-PHOTOCONDUCTIVE TRIGGERING DEVICE

Max Krawitz, Seneca Falls, N.Y., assignor to Sylvania Electric Products Inc., a corporation of Delaware

Filed July 15, 1963, Ser. No. 295,127
3 Claims. (Cl. 315—151)

This invention relates to the sequential triggering of lamps. In particular it relates to the triggering of electroluminescent lamps utilizing a chain reaction to illuminate any desired number of these lamps.

In some forms of signal devices or display devices it is necessary to provide a bank of lamps, each individually controlled by its own switch, with the lamps arranged in such a circuit that when a particular lamp is illuminated a number of others will sequentially be illuminated. Where a large number of lamps are involved, the time period required to illuminate the desired number of lamps may be too long. Thus the time required for illuminating an electroluminescent lamp is about 10 milliseconds. If 50 lamps were employed, then the time required to illuminate all these lamps, were they lit in a chain reaction, would be 500 milliseconds. This time period, for some purposes, may cause too much of a delay in the operation of the lamps.

It is an object of this invention to provide a circuit which shall shorten the time required to illuminate a desired number of lamps and yet provide for selective operation of any number of lamps in a bank.

For a better understanding of the present invention, together with other and further objects, advantages, and capabilities thereof, reference is made to the following disclosure and appended claims in connection with the accompanying drawings in which:

FIG. 1 is a circuit diagram of a known form of display device utilizing electroluminescent lamps;

FIG. 2 is a circuit diagram, in accordance with the invention, utilizing a means for illuminating a desired number of lamps in a short period of time; and

FIG. 3 is a similar diagram showing a modification of the invention.

Referring more in detail to the prior art of FIG. 1, it will be noted that the same discloses a pair of mains **10** and **12** coupling with an A.C. generator **14**. Bridging the mains are electroluminescent lamps, each in series with a switch. Thus as illustrated in FIG. 1, there is disclosed five combinations of electroluminescent lamps and switches, **20, 21**; **22, 23**; **24, 25**; **26, 27**; and **28, 29**. Associated with each of the electroluminescent lamps and in a position to be irradiated by these lamps are photoconductive cells. The photoconductive cell **31**, in position to be irradiated by the electroluminescent lamp **20**, is in shunt relation to the switch **23**. Similarly, the photoconductive cell **32** associated with the lamp **22** shunts the switch **25**; photoconductive cell **33** shunts switch **27**; photoconductive cell **34** shunts switch **29**; photoconductive cell **35** shunts the next switch **30**; and so on down the entire number of electroluminescent lamps and associated photoconductive cells and switches.

When any switch, such as switch **23**, is closed, the associated lamp **22** will be caused to become luminescent thereby irradiating the associated photoconductive cell **32** and lowering its resistance so that the voltage imposed on the next electroluminescent lamp **24** in the chain of lamps becomes sufficiently high to illuminate the lamp. This lamp **24** in turn will lower the resistance of photoconductive cell **33** thereby causing lamp **26** to become luminescent, and so on down the chain of lamps. It will be noted by this prior art arrangement that the period of time required for illuminating all the lamps is in direct

proportion to the number of lamps in the chain and the time required to illuminate one of them.

In accordance with the invention and disclosure in FIG. 2, the time required to illuminate a desired number of lamps is substantially halved.

In FIG. 2 there is illustrated a pair of mains **10** and **12**, as before, and a generator **14** connected to the mains via a switch **36**. Shunting the mains are series connected electroluminescent lamps and switches. In the drawing six such lamps and series connected switches are illustrated, namely, **40, 41**; **42, 43**; **44, 45**; **46, 47**; **48, 49**; and **50, 51**. It is obvious that as many more such combinations of lamps and switches may be utilized as may be desired. Associated with the lamp **40** are two photoconductive cells **53** and **54**. Associated with the next lamp **42** is only one photoconductive cell **55**. Succeeding electroluminescent lamps likewise have associated with them, in alternation, two photoconductive cells and one photoconductive cell. Referring back to the photoconductive cells **53** and **54**, photoconductive cell **53** shunts switch **43** which is associated with the next lamp **42** in the bank of lamps. Photoconductive cell **54** shunts the switch **45** which is associated with the second lamp **44** beyond the lamp **40**. Thus with the main switch **36** closed, closure of switch **41** effects illumination of lamp **40**. As a result, both photoconductive cells **53** and **54** would be irradiated to energize not only the lamp **42** but also lamp **44**. Lamp **44** in turn would irradiate the pair of photoconductive cells **56** and **57**, and these in turn would energize lamps **46** and **48** and so on down the chain of lamps. Thus the time required to illuminate the lamps would be about one-half that which is required to illuminate the same number of lamps in accordance with circuitry of FIG. 1. Since it is desirable to use as few photoconductive cells as possible, alternate electroluminescent lamps such as **42, 46, 50**, and so on are associated with only a single photoconductive cell as **55, 58**, and **61**. However, an initial illumination of a lamp associated with a single cell, as by closure of switch **43**, would short the switch of the next lamp. Since the next lamp has two photoconductive cells associated with it, the double chain reaction previously disclosed will take place. The time required for illumination of these lamps in this circumstance would therefore be about one-half the time required to illuminate a similar number of lamps in accordance with the arrangement of FIG. 1 plus the time required to illuminate the one additional lamp **42**. It is obvious that opening of switch **36** will extinguish all of the lamps in the bank which had been lit.

In accordance with the circuitry of FIG. 3, the time required to illuminate the lamps is substantially one-third that required to illuminate a similar number of lamps in FIG. 1. As in FIG. 2, mains **10** and **12** are provided as well as the generator **14** and the main switch **36**. As in the previous form of the invention, there will be provided a number of lamps and associated series connected switches such as **62, 63**; **64, 65**; **66, 67**; **68, 69**; **70, 71**; **72, 73**; **74, 75**; and so on. Associated with the electroluminescent lamp **62** are three photoconductive cells **76, 77**, and **78**. Photoconductive cell **76** shorts switch **65** of the next lamp **64** in the chain; photoconductive cell **77** shorts switch **67** of the lamp **66** twice removed from the lamp **62**; and photoconductive cell **78** shorts switch **69** thrice removed from the lamp **62**.

Upon closure of main switch **36** and the selected one of the series connected switches, for example switch **63**, the three photoconductive cells will be irradiated thereby causing illumination of the next three lamps **64, 66**, and **68**. Illumination of lamp **68** will irradiate a like number of three cells **79, 80**, and **81** and these simultaneously will short the switches **71, 73**, and **75** thereby causing illumi-

nation of the next three lamps **70**, **72**, and **74**. In a like manner, the illumination of lamp **74** will irradiate three other photoconductive cells thus continuing the chain reaction down the bank of lamps. Associated with a second one of a triad of lamps, as lamps **64** and **70**, are two photoconductive cells **82** and **83**, the cell **82** shunting the switch **67** and the cell **83** shunting the switch **69**. Should the series switch **65** be closed, instead of switch **63**, to illuminate lamp **64** and the lamps further down in the bank of lamps, the lamps controlled by switches above switch **65** will not be illuminated. Note that the two lamps **66** and **68** below lamp **64** will be illuminated simultaneously. Since lamp **68** is illuminated, the triple chain reaction previously described will again take place. Associated with the third of the triad of lamps is a single photoconductive cell **84**, this cell shorting switch **69**. When this cell is irradiated, as for example by closure of switch **67**, the lamp **68** will become illuminated, irradiating the three photoconductive cells associated therewith again causing the triple chain reaction of the illumination of the different lamps as heretofore described. Thus the time required for illuminating the lamps of a bank in accordance with the circuitry of FIG. 3 is substantially one-third that required with the circuitry of FIG. 1. It is to be noted that there is a saving in the use of photoconductive cells, each triad of lamps such as **62**, **64**, and **66** having associated therewith photoconductive cells in descending numbers, as three cells for lamp **62**, two cells for lamp **64**, and one cell for lamp **66**. It is obvious from the above that groups of four or more lamps and associated descending order of photoconductive cells may be utilized to save still more time in the lighting of a selected number of lamps.

Thus the applicant has provided means whereby time may be gained in the illumination of a desired number of lamps in a bank of lamps coupled with a saving in the number of photoconductive cells required to be associated with the lamps. While the switches in series with the lamps and the generator are illustrated as knife switches, it is obvious that they may be of any character desired so long as they perform a switching function.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention as defined by the appended claims.

Having thus described my invention, what is claimed is:

1. Means for triggering lamps to become lit comprising an energizing source, a lamp, and a switch in series therewith connected to the energizing source, a number of photoconductive cells adapted to be irradiated by the lamp, a second lamp and series connected switch connected to the energizing source, a number of photoconductive cells adapted to be irradiated by the second lamp, there being one less photoconductive cell irradiated by the second lamp than by the first lamp, a third series connected lamp and switch across the energizing source, and at least one photoconductive cell irradiated by said third lamp, one of the photoconductive cells of the first lamp bridging the switch of the second lamp, a second photoconductive cell of the first lamp bridging the switch of the third lamp, the photoconductive cell associated with the second lamp bridging the switch of the third lamp and the photoconductive cell adapted to be irradiated by the third lamp adapted to bridge yet another switch.

2. Means for triggering a desired number of lamps to be lit comprising an energizing circuit, groups of lamps across said energizing circuit, each lamp of the group having a switch in series with the lamp and photoconductive cells associated with the lamps in position to be irradiated by the lamps, the first lamp being adapted to irradiate a number of such cells, the second lamp of the group being adapted to irradiate one less member of photoconductive cells and succeeding lamps of the group adapted to irradiate successively one less photoconductive cell, each photoconductive cell being in shunting relation to a switch of another lamp.

3. Means for triggering lamps arranged in groups to be lit comprising an energizing circuit, each lamp of a group having a switch in series therewith in the energizing circuit and each lamp having photoconductive cells individual thereto in position to be irradiated by the lamp, a first lamp of the group irradiating a multiplicity of said cells individual thereto and each succeeding lamp of the group irradiating one less cell individual to it, said cells each bridging a switch of a lamp not irradiating said cell.

No references cited.

DAVID J. GALVIN, *Primary Examiner.*

R. JUDD, *Assistant Examiner.*