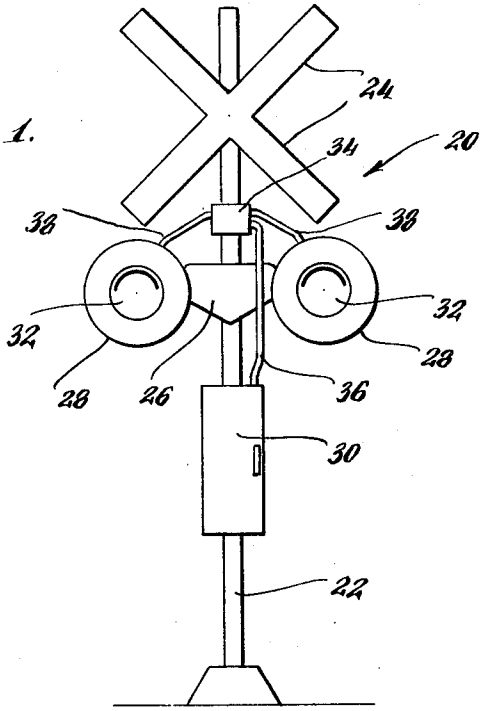
June 25, 1968 H. A. SCOTT ETAL 3,390,304

HIGH INTENSITY RAILROAD CROSSING SIGNALS WITH SEPARATE FREQUENCIES OF REPETITION FOR LAMPS AND RELAY FLASHER

Filed Sept. 12, 1966 2 Sheets-Sheet 1

Fig. 1.



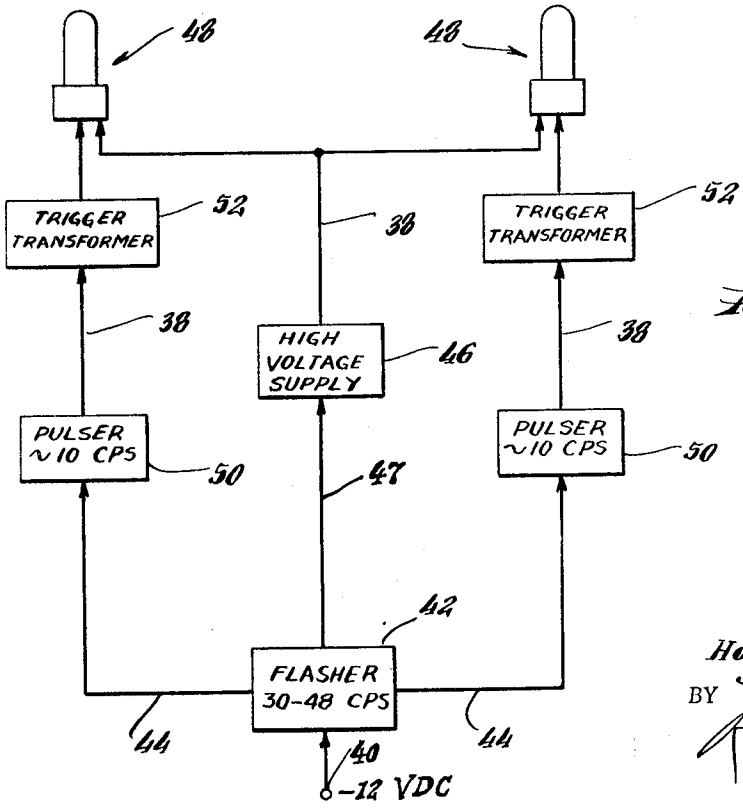


Fig. 2.

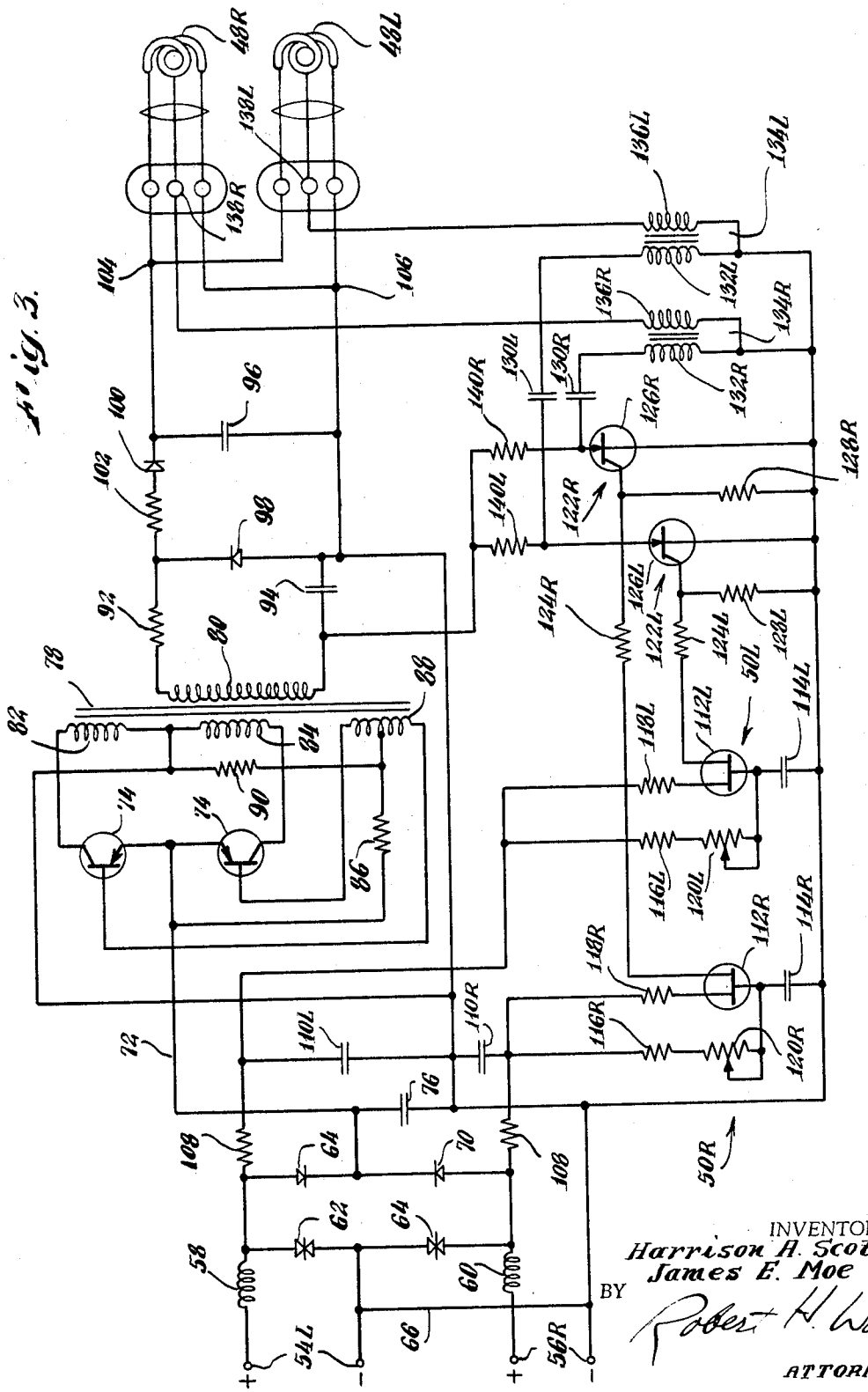
INVENTORS.
Harrison A. Scott
James E. Moe
BY
Robert H. Ware
ATTORNEY.

June 25, 1968 H. A. SCOTT ET AL. 3,390,304

HIGH INTENSITY RAILROAD CROSSING SIGNALS WITH SEPARATE FREQUENCIES OF REPETITION FOR LAMPS AND RELAY FLASHER

Filed Sept. 12, 1966 2 Sheets-Sheet 2

Fig. 3.



INVENTORS.
Harrison A. Scott
James E. Moe
BY
Robert H. Ware
ATTORNEY.

United States Patent Office 3,390,304 Patented June 25, 1968

3,390,304

HIGH INTENSITY RAILROAD CROSSING SIGNALS WITH SEPARATE FREQUENCIES OF REPETITION FOR LAMPS AND RELAY FLASHER

Harrison A. Scott, Minneapolis, Minn., and James E. Moe, Ridgewood, N.J., assignors to Railroad Accessories Corporation, Cresskill, N.J.

Filed Sept. 12, 1966, Ser. No. 578,591
9 Claims. (Cl. 315—217)

ABSTRACT OF THE DISCLOSURE

A high intensity railroad crossing signal comprising a pair of gas discharge lamps mounted within the existing lamp housings of such a signal and power supply therefor connected to the existing flasher relay of the installation. The high voltage power supply is of the type commonly used in automobiles to replace older multivibrator types and it is connected to the flasher relay terminals such as to be continuously energized by the direct current supplied thereto.

Rather than merely alternately energizing the high intensity flash lamps at the usual 30 to 48 cycles per minute rate of existing railroad crossing signals, during each of its energization intervals a lamp is multiply-energized approximately five times at a rate of approximately ten cycles per second. The flash lamps are thus repeatedly energized for a period of 10 to 15 milliseconds each time, this being the average integration time of the human eye. The ten cycles per second flash rate produces the psychological impression that the lamps are each on half of the time.

Each of a pair of unijunction transistor, resistor-capacitor, pulser circuits is connected to the flasher relay terminals corresponding to each lamp. This controls a solid state switch connected in circuit with a trigger transformer and a capacitor charged from the high voltage power supply to trigger the flash lamps at the desired ten cycles per second rate. The existing flasher relay provides the alternate periods of multiple energization of each lamp at the rate of approximately 30 to 48 cycles per minute.

This invention relates to high intensity railroad crossing signals. More particularly, it relates to such crossing signals employing high intensity gas-filled arc discharge tubes.

The invention provides a pair of gas-discharge lamps mounted in a conventional railroad crossing signal installation. The lamps are alternately energized at substantially the same rate as the prior art incandescent lamps. However, the invention provides a plurality of flashes upon energization of each lamp. That is, each lamp is alternately energized at a rate of 30 to 48 times per minute and during energization each lamp is discharged or flashes approximately five times. We have found that this rate gives the greatest visibility and psychological impression of intensity and that the lamps appear to the observer to be on and off for approximately equal durations although, of course, each discharge in the lamps exist for only a few milliseconds; the longer duration psychological impression being provided by persistence of vision.

The invention provides a high intensity railroad crossing signal as above-described without fundamentally altering an existing crossing signal installation. That is, the discharge lamps are mounted within the pre-existing lamp housings; the alternate flashing of the lamps is provided by the existing flasher relay; and electrical power supplied by the flasher relay is utilized by a novel control circuit, also mounted to the pole of the crossing signal, to energize the discharge lamps with a high voltage and to provide

trigger signals to flash them at the preferred rate of approximately five flashes per energization.

As automobiles have become increasingly powerful in the past twenty years, road traffic speed has greatly increased. This is true not only of limited access so-called superhighways but also of secondary roads that do have grade crossings and road intersections. Especially high speeds are prevalent in the great plain areas stretching between the Appalachians and Rocky Mountains of the United States. As average speeds have increased, highway engineers have recognized that traffic signals must be made more visible at greater distances in order to be effective. It has been found that the standard 69 watt incandescent lamp for a red signal is no longer sufficient. Wattage has steadily increased to 150, then to 200 watts; 500 watt lamps are being proposed for some newer installations. Highway engineers have been able to utilize such high power lamps because their traffic signals are connected to ordinary alternating current power lines. However, the railroads have not been able to employ such high intensity lamps because of the requirement that signals at railroad grade crossings have standby battery power to be capable of operating during a power failure.

We realized that other forms of lamps existed which were more efficient users of power than incandescent lamps. One of these, which is particularly efficient and converts nearly all of the electrical energy used to visible light, is the gas-discharge lamp such as now commonly used to replace flashbulbs in photography. However, we found that such flash lamps could not be effectively used in the same way that prior art incandescent lamps were utilized in a railroad crossing signal; that is, by merely alternately energizing the lamps from one arm to the other of the signal at the rate of 30 to 48 cycles per minute. Such a railroad signal we found was very effective at night. However, during the daytime the effectively perceived flash, being no longer than approximately one-twentieth of a second, (the persistence of vision of the average observer) would not be noticed in the bright sunlight.

Fortunately, we later discovered that a series of flashes from a gas-discharge lamp for the same duration of time that the incandescent lamp of a prior art railroad crossing signal is illuminated was perceived in daylight and was much more effective than the prior art incandescent lamps both day and night.

It is, therefore, an object of the present invention to provide a high intensity railroad crossing signal.

Another object of the invention is to provide such a railroad crossing signal at existing railroad crossing signal installations.

A further object of the invention is to provide such a high intensity railroad crossing signal utilizing substantially the same amount of power as existing railroad crossing signals.

A yet further object of the invention is to provide such a high intensity railroad crossing signal utilizing gas-discharge lamps.

Another object of the invention is to provide such a high intensity railroad crossing signal exhibiting psychological high intensity and visibility during daylight.

Still another object of the invention is to provide such a high intensity railroad crossing signal providing lamp life equal to or greater than that of the prior art incandescent lamps used in railroad crossing signals.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed disclosure taken in connection with the accompanying drawings in which:

FIGURE 1 is a side elevation of an existing railroad crossing signal installation in which the high intensity railroad crossing signal of the present invention is employed.

FIGURE 2 is a block diagram of the high intensity railroad crossing signal of FIGURE 1; and

FIGURE 3 is a schematic electrical circuit diagram of the high intensity railroad crossing signal of FIGURE 1.

The same reference characters refer to the same elements throughout the several views of the drawings.

Now referring to FIGURE 1, an existing railroad crossing signal installation is generally indicated at **20**. It comprises the usual mast **22**, crossed warning signs **24**, cross arm **26**, and lamp housings **28—28**. Also mounted to the mast **22** is a control box **30** in which is mounted the flasher relay of the prior art.

According to the present invention, gas-discharge lamps are mounted within the housings **28—28** and the existing Fresnelled red lenses **32—32** are removed and replaced by plain glass red filters. A high voltage power supply and lamp pulsers are mounted in control box **34**, also mounted to mast **22**. Power is supplied from the flasher relay to control box **34** via cable **36** and high voltage and trigger pulses are supplied from control box **32** to the lamps in housings **28—28** via cables **38—38**.

Within the control box **30** there is provided at the prior art installation a source of minus 12 volts DC power and this is supplied to the system at terminal **40** (FIGURE 2). The 12 volts is supplied to the existing flasher relay **42** and it alternately energizes conductors **44—44** at a rate of 30 to 48 cycles per minute; this being standard in the railroad industry. It is approximately the rate of lantern swinging of the average crossing attendant replaced by the automatic signal.

A high voltage power supply **46** is connected to the flasher **42** via cable **47**. It supplies high voltage continuously across the gas-discharge lamps generally indicated at **48—48**. Pulsers **50—50** are provided and when energized via their respective conductors **44—44**, they produce pulses at an approximate rate of ten per second. These pulses are supplied via cables **38—38** to trigger transformers **52—52**, which may be supplied by the manufacturer of the discharge lamps **48—48** and are preferably mounted within the lamp housings **28—28**. The trigger transformers **52—52** produce in response to each pulse supplied by the pulsers **50—50** a high voltage triggering pulse that causes the lamps **48—48** to discharge. Each pulser is preferably adjusted to provide approximately five pulses during the period that the pulser is energized by the flasher relay.

In order to make the most effective use of the available power, the circuit is adjusted so that the lamps **48—48** are discharged for approximately 10 to 15 milliseconds, this being the maximum average integrating time of the eye of a normal observer.

More specifically, and referring to FIGURE 3, the flasher relays of the prior art provide two pairs of terminals, left terminals **54** and right terminals **56** alternately energized at a rate of 30 to 48 cycles per minute. The present invention provides some transient protection by connecting coils **58** and **60** and four-layer junction devices **62** and **64** as shown. These cause over-voltages across the terminals **54** and **56** to be harmlessly shorted and dissipated in the inductors **58** and **60** and in the other wiring in the control box **30** (FIGURE 1).

The negative terminals **54** and **56** are connected together by conductor **66**. The positive terminals **54** and **56** are connected through inductors **58** and **60** and diodes **68** and **70** respectively to conductor **72**. Conductor **72** is in turn connected to the emitters of high voltage power supply transistors **74—74**. A capacitor **76** is connected between the cathodes of diodes **68** and **70** and the negative terminals **54** and **56**. In a manner well known to those skilled in the art capacitor **76** is alternately charged and then discharged through a high voltage transformer **78** to produce a high voltage pulsating direct current through its secondary winding **80**. Primary coils **82** and **84** are connected to the collectors of transistors **74—74** as shown; the midpoint between primary coils **82** and **84** being connected to the negative terminals **54** and **56**. Positive conductor **72** is connected through a resistor **86** to coil **88**. A resistor **90** is connected between the midpoint between coils **82** and **84** and the midpoint of coil **88**. The output of high voltage transformer secondary **80** is filtered by resistor **92** and capacitor **94**, which are connected in a voltage doubler arrangement with capacitor **96**, diodes **98** and **100** and resistor **102**. The resulting high voltage across terminals **104** and **106** is continuously applied across lamps **48—48**.

In order to provide trigger pulses to the lamps **48—48**, pulsers **50—50** are provided. The right pulsers **50R** are connected through coil **60** and resistor **108** to right positive terminal **56**. Capacitor **110R** shorts transients to ground. A uni-junction transistor oscillator comprising uni-junction transistor **112R**, capacitor **114R**, resistors **116R** and **118R**, and variable resistor **120R** is connected in circuit as shown. In accordance with principles well known in the art, when positive terminal **56** is supplied with power by the flasher relay **42** (FIGURE 2), capacitor **114R** begins charging through resistors **108**, **116R** and **120R**. No current flows through resistor **118R** because the uni-junction **112** is an open circuit between its two base terminals. However, when the voltage across capacitor **114R** reaches a value greater than the trigger voltage as determined by the intrinsic standoff ratio of the uni-junction **112R**, the two bases become shorted and capacitor **114** is discharged through the trigger circuit **122R**. After capacitor **114** discharges, the uni-junction **112R** turns off and the action begins again. The rate at which this action takes place is determined by the charging time of capacitor **114R** through variable resistor **120R**. As previously stated, it is preferably adjusted to give approximately five flashes; that is, one each tenth of a second for the duration of illumination of the right hand lamp **48R**.

The current of the discharging capacitor **114R** passes through resistor **124R** to fire the trigger of SCR **126R**; the trigger being biased through resistor **128R**. Short-circuiting of the SCR discharges capacitor **130R** through the primary **132R** of trigger transformer **134R** producing an extremely high voltage of approximately 10,000 volts across the secondary **136R**. This is supplied to the trigger terminal **138R** of the right lamp **48R**. As is well-known to those skilled in the art, trigger terminal **138R** is connected to an encircling external electrode and the ions produced by energizing this electrode cause the flash lamp **48R** to fire.

Capacitor **130R** is charged through resistor **140R** from the secondary **80** of the high voltage transformer **78**. The left pulser **50L** and left trigger circuit **122L** operate in the same manner as described with reference to the right pulser **50R** and right trigger circuit **122R**. The components are given the same reference characters followed by L.

The values of the components illustrated in FIGURE 3 are as follows: Inductors **58** and **60** may be 170 millihenrys; four-layer devices **62** and **64** may be GE type 6RS21SAIDI; diodes **68** and **70** may be Mallory type MR1031B; resistors **108** are 100 ohms; capacitor **76** is 500 microfarads, 25 volts; capacitors **110R** and **110L** are each 10 microfarads, 50 volts; transformer **78** may be a Triad type TY71S; transistors **74** may be type 2N458A, resistor **86** is 470 ohms, 1 watt; resistor **90** is 1.5 kilohms; resistor **92** is 750 ohms; 10 watts, capacitor **94** is 20 microfarads, 450 volts; capacitor **96** is a 10 microfarads, 600 volt, oil-filled capacitor; diodes **98** and **100** are

Sarkes Tarzian Type F8, resistor **102** is a 750 ohm, 10 watt resistor. The gas-discharge lamps are preferably a heavy gas type, such as an Amglo P/N HD–30 that uses Xenon. When these lamps are used, Amglo type MT–55 transformers **134R** and **134L** are used. In that case, SCR's **126** are Texas Instruments type 145A3; resistors **124** are 220 ohms; resistors **128** are 680 ohms; resistor **140** is 100 kilohms; and capacitor **130** is .22 microfarads, 400 volts.

In the pulser circuits **50**, uni-junctions of type 2N2160 may be used. In this case capacitors **110** are 10 microfarads, 50 volts capacitors; resistors **116** and variable resistors **120** are 100 kilohms—resistors **116** being preferably of the deposited carbon type; resistors **118** are 180 ohms, and capacitors **114** are **2** microfarads, 100 volts.

In all cases above if the power capacity of the resistor is not given, it is one-half watt.

It will be understood to those skilled in the art that many changes may be made in the above-described circuit of FIGURE 3 without departing from the scope of the invention. For example, various forms of oscillators may be employed for the pulsers **50R** and **50L**; various trigger circuits **122R** and **122L** may be employed. Furthermore, other high voltage power supplies may be utilized than that disclosed. However, it is a feature of the invention that the high voltage power supply that we do use is connected to the output of the existing flasher relay rather than being connected directly to the 12 volt supply at the signal installation.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A high intensity railroad crossing signal comprising:

(A) a spaced pair of very high intensity lamps;

(B) pulsing means for repeatedly automatically flashing a lamp at first repetition rate;

(C) and alternating means arranged to repeatedly automatically connect said pulsing means to said lamps alternately at a second repetition rate slower than said first repetition rate;

(D) the respective repetition rates of said means being such that the interval during which each lamp is continuously connected to said pulsing means is long enough to include a plurality of flashes by said pulsing means.

2. A high intensity railroad crossing signal as defined in claim **1** wherein said pulsing means energizes said lamps during each of said flashes for an interval of approximately 10 to 15 milliseconds.

3. A high intensity railroad crossing signal as defined in claim **1** wherein said pulsing means flashes each lamp approximately five consecutive times during each said continuous connection interval.

4. A high intensity railroad crossing signal as defined in claim **3** wherein said pulsing means flashes each lamp approximately every ten seconds whereby to produce the psychological impression that said lamp is on continuously half of the time.

5. A high intensity railroad crossing signal as defined in claim **2** wherein said pulsing means flashes each lamp approximately five consecutive times and then flashes the other lamp approximately five consecutive times.

6. A high intensity railroad crossing signal as defined in claim **5** wherein said alternating means connects said pulsing means to each lamp approximately 30 to 48 times per minute.

7. A high intensity railroad crossing signal system for installation in an existing railroad crossing signal comprising:

(I) a spaced pair of lamp housings;

(II) a direct current power supply; and,

(III) a flasher relay for alternately connecting said direct current power supply to a first and a second pair of flasher relay terminals;

said system comprising:

(A) a pair of high intensity gas discharge lamps mounted in said lamp housings respectively;

(B) a high voltage power supply connected to both pairs of said flasher relay terminals for applying a high voltage potential across said high intensity gas discharge lamps; and

(C) each of a pair of multiple impulse trigger circuits connected between a respective pair of said flasher relay terminals and a respective one of said gas discharge lamps to supply a multiplicity of trigger impulses to flash each of said lamps a plurality of times during the connection of the respective flasher relay terminals to said direct current power supply.

8. The system defined in claim **7** wherein each of said trigger circuits comprises a trigger transformer and a capacitor connected to said high voltage power supply and a solid state switch connected for discharging said capacitor through said trigger transformer.

9. The system defined in claim **8** wherein each of said trigger circuits comprises a unijunction transistor, resistor-capacitor, timing circuit connected to trigger one of said solid state switches.

References Cited

UNITED STATES PATENTS

2,478,901	8/1949	Edgerton	315—261
2,478,903	8/1949	Edgerton	315—230 X
3,031,599	4/1962	Paschke	315—201
3,113,293	12/1963	Bresse et al.	340—83 X
3,267,328	8/1966	Girard	315—163

FOREIGN PATENTS

1,157,127	12/1957	France.

JAMES W. LAWRENCE, *Primary Examiner.*

C. R. CAMPBELL, JR. *Assistant Examiner.*