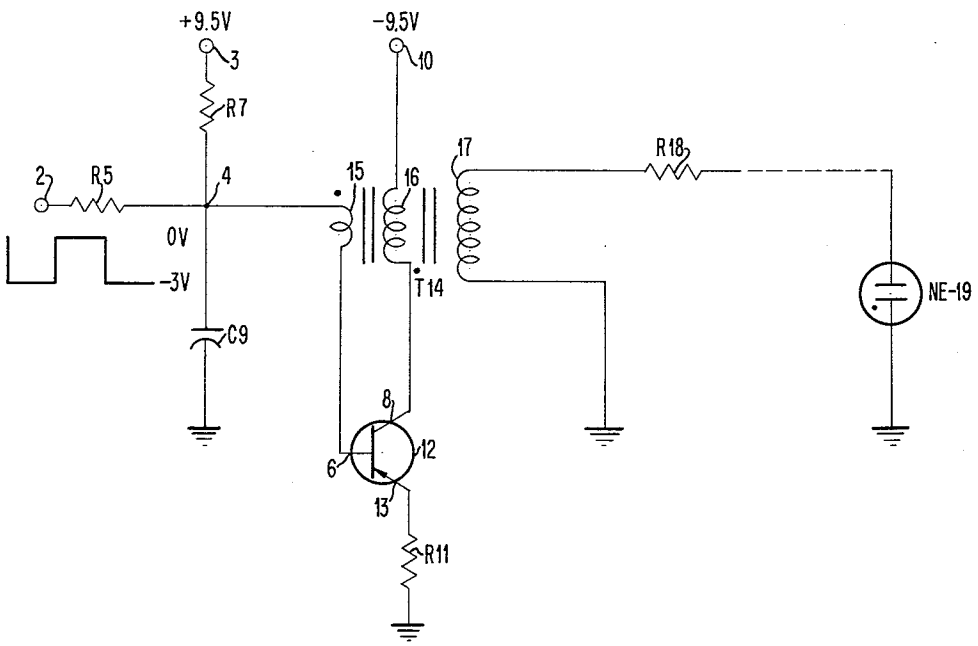
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GLOW LAMP INDICATOR CIRCUIT

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GLOW LAMP INDICATOR CIRCUIT

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This invention relates to a glow-discharge lamp (hereinafter referred to as a glow lamp) indicator circuit and more particularly to such a circuit which is controlled by a low voltage signal.

In the electronic industry it is desirable to have lamps which indicate the status of various circuits in electronic machines. Such an indicator lamp is particularly desirable in data processing machines to indicate the status of a flip-flop.

Glow lamps such as neons are desirable as indicators because they require small amounts of power, are efficient light generators, are mechanically small and rugged, are inexpensive and have proven to be more reliable than other types of indicator lights. In electronic machines which employ vacuum-tube circuits the high voltages necessary to operate glow lamps are normally available. However, components such as transistors, diodes, magnetic cores, and the like which are normally employed in solid state electronic machines commonly operate on low voltages, so high voltages are not normally available to operate glow lamps. Incandescent lamps operable with low voltages have been used as indicators, but they are not as desirable as glow lamps due to their high power dissipation, low efficiency, and lower reliability. Special high voltage circuits have been provided in some machines to ignite glow lamps, but the additional high-voltage power supply adds to the expense of construction.

Accordingly it is an object of this invention to provide an indicator circuit for low-voltage circuits using glow lamps.

It is a further object of this invention to provide an improved glow lamp indicator circuit using a low-voltage power source.

Another object of this invention is to provide an improved glow lamp indicator circuit which requires little power.

Still another object of this invention is to provide a glow lamp indicator circuit which is reliable and inexpensive.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawing, which discloses, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

Briefly, this invention, according to the preferred embodiment, provides a glow lamp indicator circuit which accepts a relatively low-voltage input signal from a circuit whose status is to be indicated. This input voltage is much less than that required to ignite the glow lamp directly and may have two magnitudes, one being more positive than the other. The input signal gates an oscillator. The oscillator is comprised of a transistor and a three-winding transformer, one winding of which is driven by the transistor. A second winding provides feed-back to the transistor. The third winding, which has more turns than the first or second windings, supplies a sufficiently high voltage to ignite a glow lamp and therefore to indicate the status of the circuit from which the input signal is derived.

The figure is a schematic diagram of the preferred embodiment constructed in accordance with the principles of this invention. This preferred embodiment of the invention will be described with reference to the figure.

The signal from the circuit whose status is to be indicated is applied to the indicator circuit point 2. The input signal is at ground potential (zero volts) when the circuit whose status is to be indicated is in the Off state and at a —3 volt potential below ground when On is to be indicated.

The —3 volt potential (On) applied to point 2 turns PNP transistor 12 on, starts a self-sustaining oscillatory current in transformer T14 and transistor 12 which induces a voltage in winding 17 of transformer T14, igniting neon 19. The ignited neon indicates the On state of the circuit from which the —3 volt input signal was received.

The ground or zero volt potential (Off) applied to point 2 turns off transistor 12, preventing oscillation. Thus no voltage is induced in winding 17, and the neon 19 will be extinguished.

The circuit will now be described in more detail in its Off condition.

When the input signal to point 2 is at zero volts a voltage is developed at point 4 due to the divider action of R5 and R7 which is positive with respect to ground. This positive potential on the base 6 of the transistor 12 prevents conduction in the transistor. With the transistor in this state there is no change of current in winding 16 of transformer 14 and hence no voltage is induced in either winding 15 or 17 and the glow lamp will be extinguished.

The circuit is next described in more detail in its On condition.

When the input signal to point 2 is changed from zero to —3 volts the voltage developed at points 4 and 6 drops to zero or less volts, allowing the transistor 12 to conduct. The change in current flow from the collector 8 through transformer winding 16 induces a voltage in winding 15 which tends to cause the base 6 to be driven more negative thus causing an increase in the current through transistor 12. When transistor 12 is saturated there can be no further change of current in winding 16. The voltage induced in winding 15 then decreases causing the current through transistor 12 to decrease. The decreasing change in the current through winding 16 induces a positive voltage in winding 15 which reduces conduction current from base 8 of transistor 12 down to zero, when the transistor 12 is said to be cut off. Once cut off the base current ceases to flow and the voltage induced in winding 15 returns to zero, and the transistor begins the conduction cycle just described again. The cycle repeats until the input voltage at point 2 is shifted to ground potential. Transformer 14 and transistor 12 thus operate as an oscillator. The frequency is irrelevant as any frequency, including zero, will ignite glow lamps.

The alternating currents in windings 15 and 16 induce voltages in winding 17 of sufficient magnitude to ignite glow lamp 19.

Resistor R11 is placed in the emitter lead of transistor 12 to limit the dissipation in transistor 12 should the circuit fail to oscillate. This failure might occur if winding 17 were short-circuited. Resistor R18 is placed in series with the neon glow lamp to limit current. Capacitor C9 provides a low impedance path for the alternating current developed in winding 15. The frequency of oscillation is primarily dependent upon the inductance and stray capacitance of transformer 14. The circuit may be tuned with capacitors in parallel with one or more of the windings. The value of R5 is chosen such that with a —3 voltage at point 2 the potential at base 6 of transistor 12 will be low enough to assure sufficient collector current to cause a strong feed-back signal to be induced in winding 15 yet minimize the current drawn from or sent to the circuit connected to the input. Resistor R7 is so chosen that the voltage at the base of transistor 12 will be positive with respect to ground when point 2 is at zero volts. Capacitor C9 is chosen so that it will present

a small impedance relative to R5 and R7 at the oscillator frequency.

Transformer winding **16** is chosen to have sufficient impedance at the frequency of the oscillator to provide an efficient load for transistor **12**. Winding **15** is then chosen to provide adequate current to the base of transistor **12** to cause full saturation. Winding **17** is then selected such that the voltage developed in it will ignite the neon lamp. In the embodiment illustrated the output voltage from winding **17** will be approximately 120 volts peak to peak.

Transformer T14 can be made from any ferromagnetic core with the three windings placed on it in a conventional manner. Transistor **12** must be chosen in conjunction with the neon **19** so that sufficient power is available to drive the neon. Hence any desired neon may be driven so long as an adequate transistor is provided.

The values of the components which may be utilized in the circuitry of the preferred embodiment are as follows:

Resistor **5**	ohms	10,000
Resistor **7**	do	39,000
Resistor **11**	do	200
Resistor **18**	do	100,000
Capacitor **9**	microfarads	1.0
Neon **19**		NE–2
Transistor **12**		2N43

Transformer **14** is constructed of a core material which is a ferrite with an initial permeability of approximately 100. Winding **15** has 5 turns, winding **16** has 40 turns, and winding **17** has 300 turns.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operations may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore, to be limited only as indicated by the scope of the following claim.

What is claimed is:

An indicating device for visually indicating the presence of a first or second low voltage electrical signal, said first signal being negative with respect to said second signal, comprising a transistor having collector, emitter, and base electrodes, a transformer having first, second, and third windings, said third winding having more turns than said first and second windings, said transistor having an input to said base electrode coupled through said first winding of said transformer to which said first and second electrical signals are applied, said collector electrode connected to one end of said second winding of said transformer, the other end of said second winding connected to a first potential, said emitter electrode connected to a second potential, a resistor connected in series with said emitter electrode and said second potential, said transistor and transformer being responsive to said first electrical signal to produce electrical oscillations, said transistor and said transformer being responsive to said second electrical signal to cause said electrical oscillations to cease, a glow lamp and means including said third winding of said transformer means to apply said electrical oscillations to ignite said glow lamp.

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