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**NATIONAL RESEARCH COUNCIL OF CANADA
RADIO AND ELECTRICAL ENGINEERING DIVISION**

ANALYZED



A HEAVY DUTY LAMP FLASHER

- S. A. GARDINER -

OTTAWA

NOVEMBER 1968

A HEAVY DUTY LAMP FLASHER

by:

S. A. Gardiner

Radio and Electrical Engineering Division
National Research Council

CANADA.

S U M M A R Y

This report describes a completely solid-state, high-current lamp flasher designed for cadmium sulphide cell control with a very low battery drain in the "off" condition.

November, 1968

ANALYZED

A HEAVY DUTY LAMP FLASHER

During some studies using instrumented buoys, a requirement for a heavy duty lamp flasher was encountered. The specifications for this flasher were laid down as follows:

- 1) 12-volt operation with lamp loads up to 5 amperes.
- 2) No relays or mechanical moving parts.
- 3) Independent adjustment of flash rate and flash length.
- 4) Incorporated daylight control to conserve battery power.
- 5) Satisfactory operation from 0°C to 30°C.

Although many flashers have been designed using power transistors as current switches, it was decided to use silicon-controlled rectifiers to get away from the heavy base drive current that transistors require. Admittedly, the IR drop in a germanium power transistor is less than that in a silicon-controlled rectifier. However, at 12 volts, this was considered unimportant and would only work toward extending lamp life.

To generate the basic flash rate, a unijunction transistor is used in a relaxation circuit (see Fig. 1). Q_1 forms a trigger pulse across R_3 each time it fires and this pulse in turn fires the SCR_1 into conduction thus lighting the lamp. It will be noted that the timing capacitor C_1 receives its charging current through a zener diode which is connected to a voltage divider comprised of a CdS cell and R_1 . When the CdS cell is at its minimum resistance, (daylight condition), the voltage on the zener diode is well below its avalanche value, thus cutting off the charging current to C_1 . As the ambient light decreases, the CdS cell increases in resistance to a point where the diode will conduct and charge the capacitor, allowing the formation of the initial triggering pulse. The only daytime battery drain, neglecting leakage through Q_1 , is the 1/5 ma flowing through R_1 and the CdS cell.

To extinguish the lamp, it is necessary to trigger SCR_2 so that C_2 may be discharged through SCR_1 (capacitive commutation). The circuit which forms this trigger is another relaxation oscillator, P_2 - C_3 - Q_2 . Until the lamp is lighted, there is no voltage available to cause the charging of C_3 and the subsequent formation of the turn-off trigger pulse. However, as soon as the lamp lights approximately 12 volts appears across the timing circuit.

The length of flash is governed by P_2 which controls the charging time of C_3 . The 4.7K resistor in the anode circuit of SCR_2 is too high to allow adequate holding current to flow, permitting SCR_2 to extinguish itself when C_2 is discharged.

The flash rate and flash length adjustment controls, P_1 and P_2 worked very smoothly with no interaction whatsoever. Flash rates up to 30 per minute were used and flash lengths were varied from .1 second to 2 seconds. By adjusting the bias resistors on the unijunction transistors, it was possible to operate the flashers over a wide temperature range with no appreciable change in flash rate or length. In effect, it was found that this form of flasher was very satisfactory for its intended application and would be suitable in other jobs where similar conditions and specifications would be encountered.

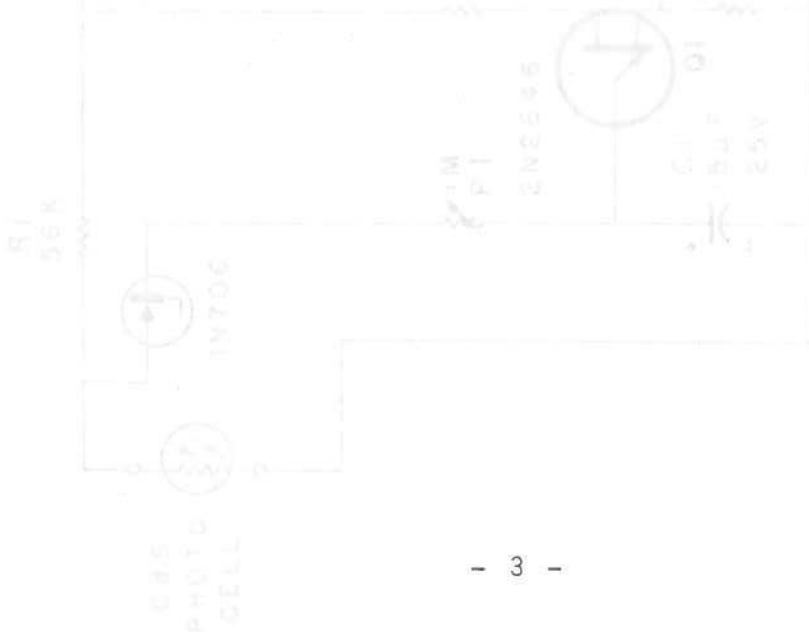


Fig. 1 - Circuit Diagram

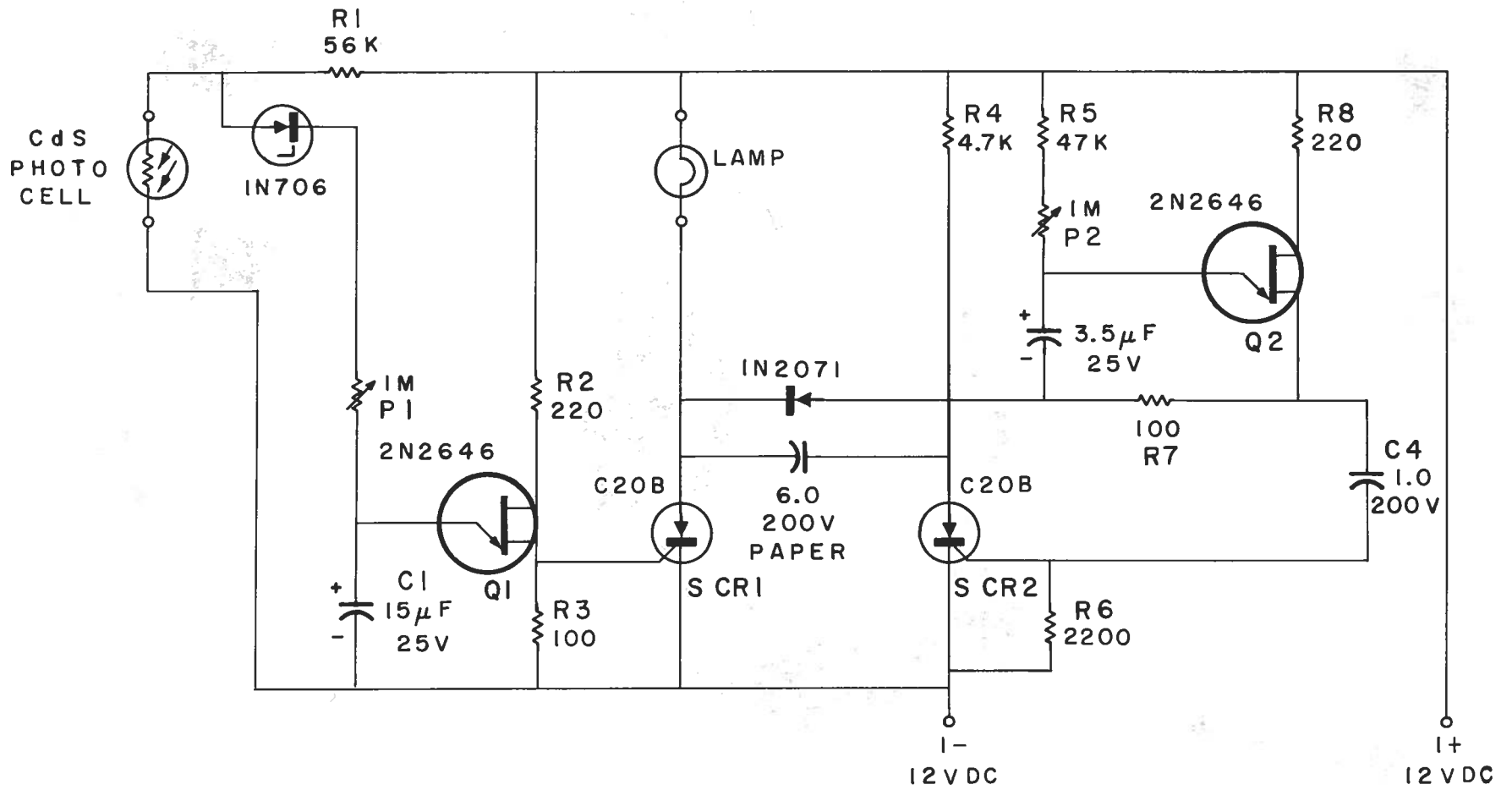
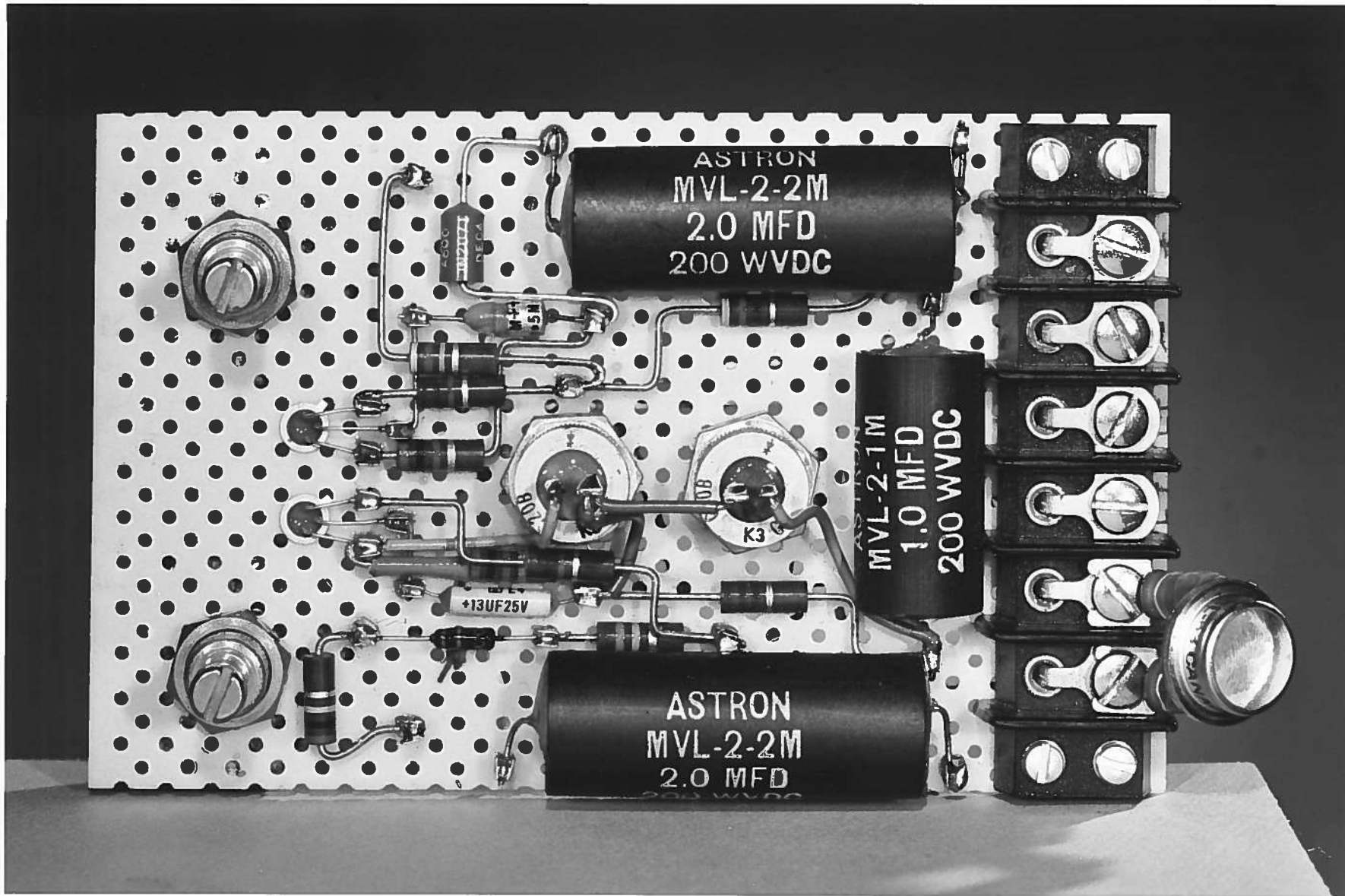


Fig. 1 - Circuit Diagram



Component Layout