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A HIGH-DUTY-CYCLE ONE-SHOT MULTIVIBRATOR CIRCUIT

Duane O. Hale

July 11, 1960

A HIGH-DUTY-CYCLE ONE-SHOT MULTIVIBRATOR CIRCUIT*

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Lawrence Radiation Laboratory
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* This work was done under the auspices of the U. S. Atomic Energy Commission.

The one-shot multivibrator commonly used as a delay, gating, and pulse-shaping unit suffers a main disadvantage of low-duty-cycle operation, because of its long recovery time. The one-shot circuit (Fig. 1) described below is capable of a 95% duty cycle.

A negative pulse applied to the base of Q1 turns Q1 on, and the positive signal appearing at the collector of Q1 turns Q2 off through C₁. As Q2 conducts less, Q1 is allowed to conduct more, and this process continues until cutoff of Q2 and saturation of Q1 is reached. Then C₁ begins charging through R₂ until the base of Q2 reaches its emitter potential. At this time, Q2 turns on and drives Q1 off through the common emitter connection. Now C₁ must discharge through the base resistance of Q2--which is low since it is turning on--and R₁. Since R₁ is a fairly large resistance, C₁ would normally take a good portion of the duty cycle discharging to its original state. However, the output pulse which went negative at the beginning of the cycle is now going positive and is applied through the differentiating network C₂ and R₃ to the base of Q3. When Q3 turns on R₁ is momentarily shorted, allowing C₁ to discharge to its original charge in approximately 5% of the duty cycle. The circuit is now ready to be triggered again.

The diode in the base circuit of Q3 eliminates the negative portion of the differentiated signal at the base of Q3.

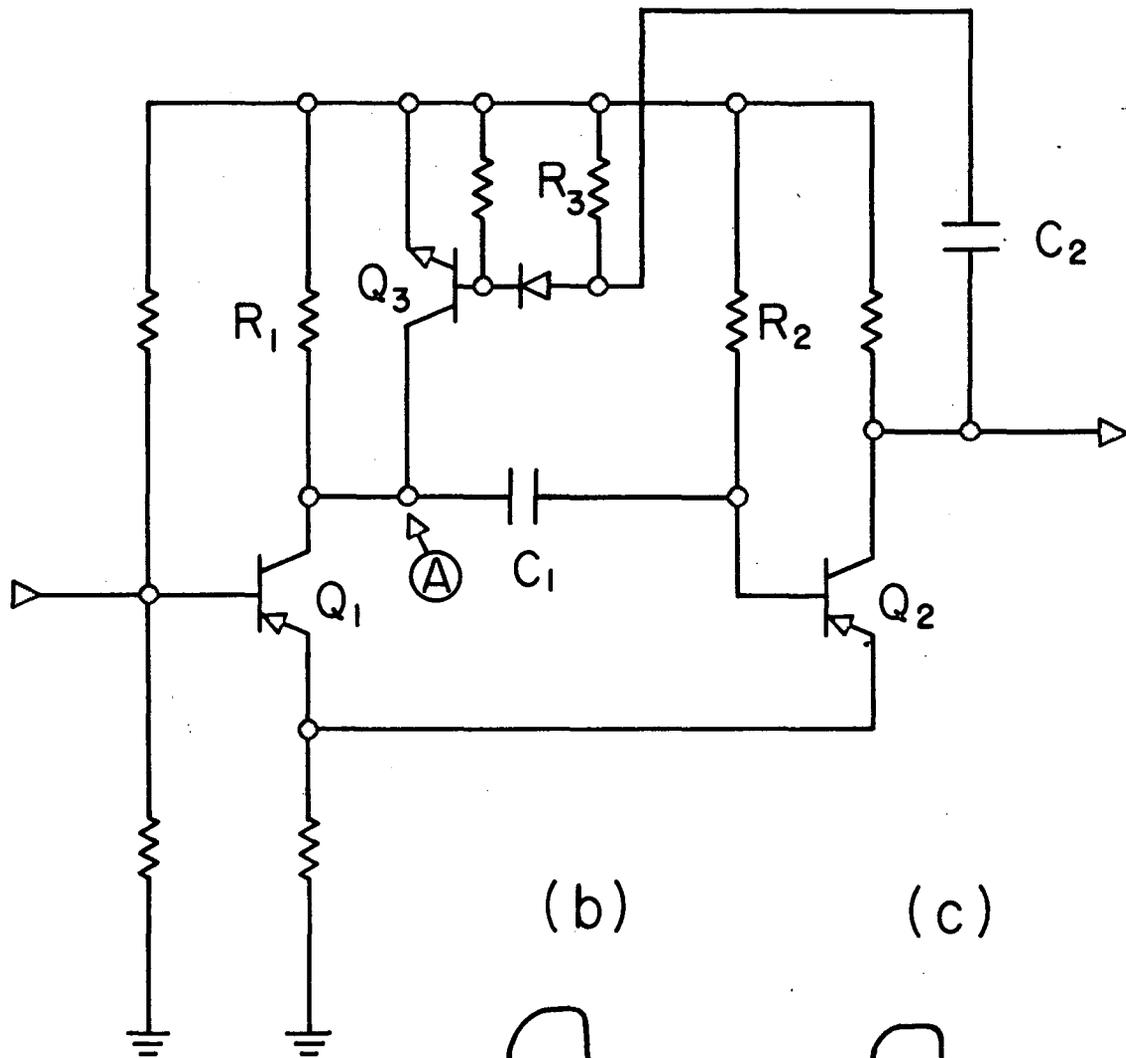
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One of these circuits is now used at Berekeley as an off gate and might be found useful in computing or pulse-shaping circuits where loss of duty cycle is not desirable.

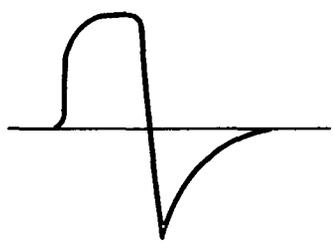
FIGURE LEGEND

Fig. 1. (a) Schematic diagram of improved one-shot circuit. (b) Typical oscilloscope trace for normal one-shot operation simulated by removing Q3. The signal was taken off at point A in the schematic diagram. (c) Signal at A with Q3 in the circuit.

(a)



(b)



(c)

