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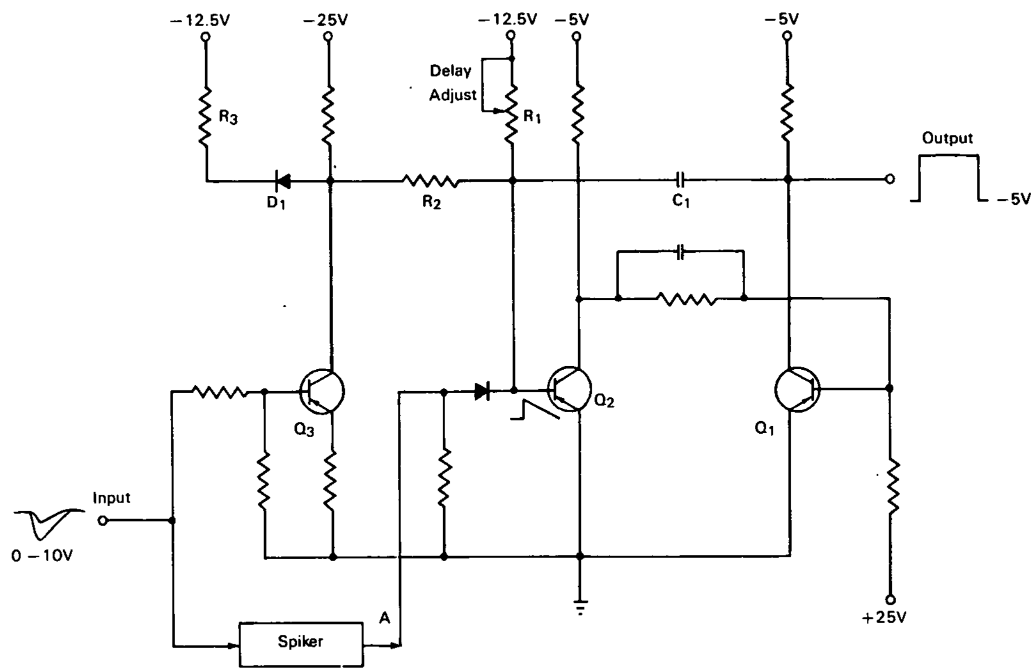
Modified Univibrator Compensates for Output Timing Errors



The problem:

To design a univibrator circuit capable of time-synchronizing the trailing edge of the output pulse with the origin of the input pulse. Conventional univibrator circuits are subject to output pulse timing errors produced by varying input pulse amplitudes.

The solution:

A simple, one-stage, delay compensation amplifier, added to the conventional univibrator circuitry so as to produce a univibrator output pulse whose trailing edge is independent of the amplitude of the input pulse.

How it's done:

The timing circuit consists of conventional univibrator Q_1 and Q_2, a spiker circuit, and one-stage compensation transistor amplifier Q_3.

In the quiescent state, Q_2 is conducting; Q_1 and Q_3 are biased off. An input pulse is applied simultaneously to the spiker circuit and to the base of Q_3. The spiker applies a positive spike to the base of Q_2, switching it off. When Q_2 stops conducting, sufficient current flows to the base of Q_1 to bias it into the conduction region. Q_1 turns on and generates a positive-going output pulse. Q_2 is held in the cut-off state by

(continued overleaf)

the potential across capacitor C_1 and remains biased off until C_1 is sufficiently discharged.

In a conventional univibrator, the discharge of C_1 is governed by the current flowing through R_1. However, in the compensated univibrator, the discharge of C_1 is governed by a discharge path through both R_1 and R_2. The potential existing at point A determines the discharge current through R_2.

An input pulse drives Q_3 into a state of increasing conduction, causing the point A potential to increase from −22v to the clamp potential of −12.5v. This decreases the discharge current flowing through R_2. From the time the clamp potential is reached to the end of the discharge, the discharge rate of C_1 is nearly constant and slower than its initial discharge rate. For high amplitude input pulses, the threshold of Q_3 and the clamp potential are reached quickly. For low amplitude input pulses, the potential at point A increases less rapidly, and the nearly constant discharge rate is reached at a later time. Thus C_1 discharges more rapidly for low amplitude input pulses than for high amplitude pulses, causing the compensated univibrator to turn off earlier for low amplitude input pulses than for high amplitude input pulses.

Low amplitude inputs reach the triggering threshold of Q_2 later than high amplitude inputs, causing a delay in the occurrence of the leading edge of the output pulse. The discharge control of C_1, however, compensates for this delay by producing narrow output pulses for small inputs and wide output pulses for large inputs. This pulse width compensation effect causes the trailing edge of all output pulses to occur at the same time regardless of input pulse amplitude.

Notes:

1. Manual adjustment of R_1 determines the pulse delay time through C_1 in the compensated circuit.
2. This circuit can function with double RC-differentiated input pulses and requires no delay-line wave shaping or zero crossing techniques.
3. Resistor R_3 and catching diode D_1 are added in the collector circuit of Q_3 to enhance the compensation for input pulses of high amplitude.
4. Additional details are contained in: *The Review of Scientific Instruments,* vol. 34, no. 11, pp. 1248–1253, November, 1963.
5. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B67-10130

Source: M. G. Strauss
Electronics Division
(ARG-85)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439