

Dekatron scaler employing transistorized drive circuits

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A scaling circuit is described which has proved extremely reliable, consisting of two dekatron stages followed by a mechanical register. The resolving time of the circuit is 250 μ sec.

1. Introduction

The scaling circuit described here consists of two dekatron stages followed by a mechanical register, all transistor driven. Pulses separated by 250 μ sec or more are counted reliably, and an average counting rate of 2500 pulses sec^{-1} , limited by the performance of the mechanical register, can be accepted. There are many experiments in nuclear physics in which counting rates of this order occur and where a circuit of extreme reliability is needed.

Transistors and dekatrons are extremely reliable components and may provide a highly reliable scaling unit when combined in a suitably designed circuit. It has been found that dekatron tubes only count reliably near their maximum speed when there is a slight overlap between the pulses applied to the guide rings, and transistorized driving circuits

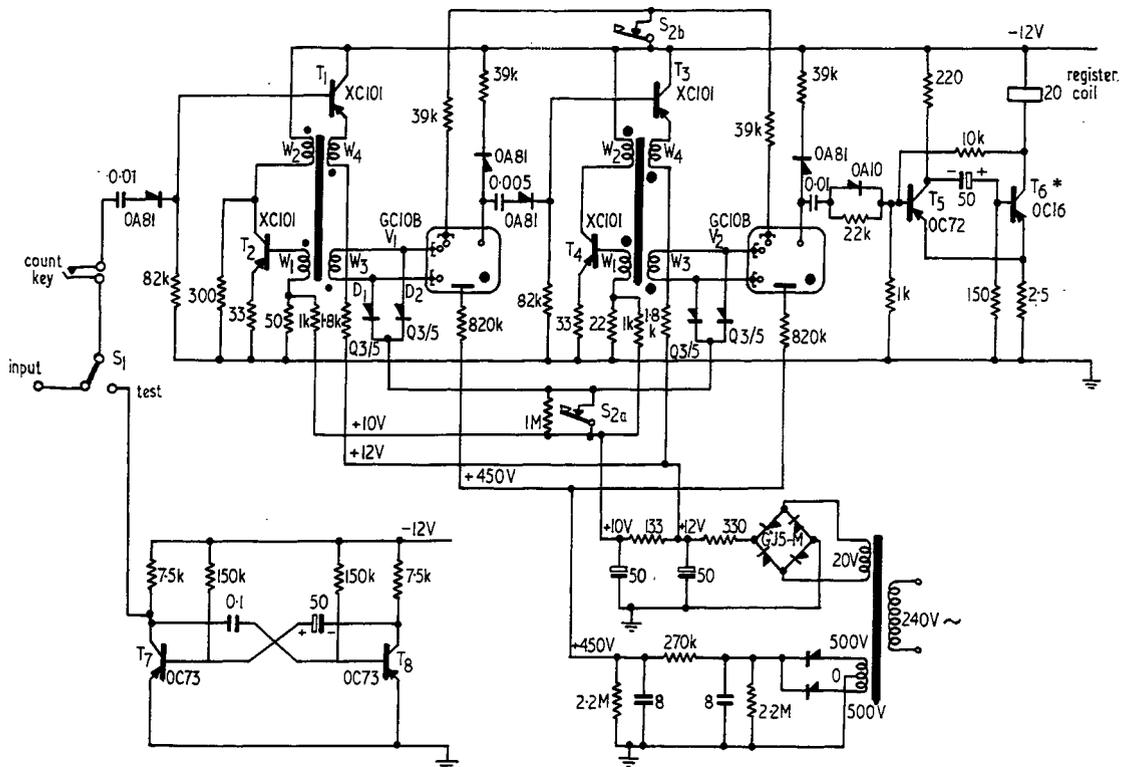
which achieve this have already been described (Chaplin and Williamson 1958, Kandiah 1958, Warman and Bibb 1958).

2. The circuit

The basic dekatron drive circuit is similar to that used by Warman and Bibb (1958) in their telephone exchange register; it employs a blocking oscillator to produce the pulses to drive the dekatron.

2.1. The first decade

The input pulses are fed through a 0.01 μ F capacitor and a type OA81 diode to the emitter follower T_1 , and so to the winding W_4 of the blocking oscillator transformer. The signal induced in W_1 overcomes the reverse bias on the base of T_2 , causing it to conduct sufficiently to give a loop



Circuit of the scaler.

* GET116 is used in a later model.

gain greater than unity in the blocking oscillator circuit. The regenerative feedback between the base and collector of T_2 then gives the typical blocking oscillator waveform of pulse and overshoot at the collector of T_2 . An enlarged version of this waveform appears across the winding W_3 . D_1 and D_2 adapt this waveform so that negative pulses are applied successively to the first and second guide rings. Stray capacitance across D_1 ensures the necessary overlap between these pulses. The signal to trigger the second decade is obtained from the leading edge of the positive-going waveform at the zero cathode of V_1 .

2.2. The second decade

There are only two differences between the first and second decades:

(1) as the second decade is required to count at only about 400 pulses sec^{-1} , there is no need for a resistor between the collector of T_4 and earth, whereas a 300 Ω resistor is required in the corresponding position in the first decade. The only effect of omitting this resistor is to lengthen the pulses applied to V_2 ;

(2) in the second decade the resistance between the base of T_4 and earth is 22 Ω , compared with 50 Ω in the corresponding position in the first stage, making the second stage more sensitive to suit the pulses available from the zero cathode of V_1 .

2.3. The blocking oscillator transformers

Laminations: Mumetal type 288, core type 402.

Windings: W_1 , 60 turns, 39 s.w.g.; W_2 , 60 turns, 36 s.w.g.; W_3 , 700 turns, 46 s.w.g.; W_4 , 160 turns, 32 s.w.g.

2.4. The register drive circuit

A pulse from the zero cathode of V_2 fires the monostable trigger circuit containing T_5 and T_6 , which provides a 20 msec pulse to drive the mechanical register. This is a faster version of the circuit recommended by Sodeco* for use with their 10 counts sec^{-1} registers; the register employed was a Sodeco type ATCeZ4E25, capable of operating at a maximum rate of 25 counts sec^{-1} .

The transistor type OC16 (T_6) is capable of a higher power

* Société des Compteurs de Genève, Switzerland. (British agents: Stonebridge Electrical Co. Ltd., London.)

dissipation than is required in this circuit, and in a later model of the scaler it was replaced by a transistor of lower power, type GET116, which is proving quite satisfactory.

2.5. Resetting

The dekatrons are reset by operating the press-button switch S_2 which disconnects the common cathodes and introduces a high resistance (1 M Ω) into the guide ring circuit to prevent the discharge being maintained to the guide rings; the discharge is thus forced to the zero cathode. The register is reset manually. Resetting the dekatrons may introduce a count in the register, which should therefore be reset after the dekatrons.

2.6. Test circuit and power supplies

Transistors T_7 and T_8 are connected in a multivibrator circuit which provides about 7 pulses sec^{-1} for test purposes.

It was not found necessary to stabilize the positive lines, and the mains transformer has an ample safety margin if rated at 20 v, 50 mA and 500–0–500 v, 20 mA. The –12 v line, rating 300 mA, was obtained from a commercial stabilized power unit.

3. Summary

The circuit responds to positive pulses greater than 5 v in height, can count pulses separated in time by more than 250 μsec and is capable of an average counting rate of 2500 pulses sec^{-1} . The scaler has been in almost continuous operation for 2½ years without giving trouble.

Acknowledgments

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