Investigations have also shown that for the operation of the converter with the above characteristics in the frequency range of 40-320 cps, resistance R (Fig. 4) must have a value in the range of 200-50 kiloohm for a scale nonlinearity of 0.02-0.05%. The readout transition period due to the slow charging of capacitor C amounted to two conversion cycles (50 μ sec) at a frequency of 40 cps and to about four conversion cycles (120 μ sec) at a frequency of 320 cps.

S. V. Rypalev participated in this work.

LITERATURE CITED.

2. Millman and Taub, Pulse and Digital Circuits, 1956,

 TRANSISTORIZED STABILIZERS FOR FEEDING TESTING INSTALLATIONS

Translated from Izmeritel'naya Tekhnika, No. 4, p. 27, April, 1961

Note to the article by S. D. Dodik and M. I. Levin.

In the schematic of the stabilizer (Measurement Techniques, No. 3, 1961, bottom of page 29) the collector of transistor T1 has been demoted as the emitter, and vice versa. The choke L should in fact be connected to the collector of T1, and the emitter of T1 should be connected to the negative side of the output voltage.

HIGH-SPEED ELECTROMECHANICAL DIGITAL VOLTMETER

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The known electromechanical voltmeters with a digital display used for measuring direct voltages are based on a compensation circuit whose balancing is achieved during measurements by the control unit which switches in consecutively (samples) the resistors in the circuit. This is done by means of commutating elements consisting of motors, step-by-step switches or relay circuits, programmed by means of a step-by-step switch. In the balancing process the difference $U_X-U_K$ between the measured and compensating voltages is decreased in consecutive steps to a predetermined procedure, until it attains a value smaller than the minimum calibration of the instrument.

The characteristic of the voltmeter here described consists in the absence of the consecutive comparison (sampling) of the measured voltage, with the voltage drop across individual resistors in the compensation circuit, i.e., a complete elimination of a long balancing process characteristic of normal instruments. Each voltmeter decade registers approximately the absolute value of the $U_X$ voltage applied to it, compares it with the corresponding value of the reference voltage, and obtains the difference $U_X-U_K$. The absolute value of this difference is approximately registered by the next decade and compared with the corresponding value of the reference voltage of that decade, etc. The main advantage of the above voltmeter consists in its high-speed operation and the easy requirements with respect to the adjustment of the decade comparing elements.
The voltmeter should consist of a source of reference voltages and of decades which are identical in construction and whose number is equal to the number of readout figures. Figure 1 shows part of the first decade in the initial state before commencing measurement. At this instant the zero readout lamp L0 is alight. When the starting push-button SP is operated the measured voltage \( U_x \) is fed to the input of the cathode follower CF, and then simultaneously to all the relaxation relays \( P_0, P_1, \ldots, P_{10} \) (of the type of driven transistor multivibrators with one stable position). Relay \( P_0 \) is tuned to operate at \( U_x \) which is equal to or larger than the voltage corresponding to the smallest readout figure (minimum calibration) of the voltmeter. It operates and closes contacts \( 1KP_0 \) and \( 2KP_0 \) locking itself across the last contact. Relays \( P_1, \ldots, P_{10} \) are tuned to operate for the values of \( U_x \) equal to 10, 20, \ldots 100 v, respectively (for the voltmeter top measuring limit of 100 v), with a negative tolerance whose absolute value, as it will be shown later, is not critical.

To the next decade

Fig. 1.

If \( U_x < 10 \) v, none of the relays \( P \) (with the exception of \( P_0 \)) will operate, and the voltage \( U_x \) will be fed to the next decade. If \( U_x > 10 \) v, all the \( P \) relays whose operating level is below \( U_x \) will operate simultaneously. However, they will immediately deenergize with the exception of the highest figure relay (and relay \( P_0 \)), since each higher figure relay disconnects by its contacts \( (2KP_1, 2KP_2, \ldots) \) the supply to the relays of lower figures. If \( U_x > 100 \) v relay \( P_{10} \) will operate and connect the signal lamp inscribed "\( U_x > 100 \) v." Let us assume that \( U_x = 32.5 \) v, and that relay \( P_3 \) has operated. It locks itself over contact \( 1KP_3 \), and connects \( U_x \) by means of contact \( 3KP_3 \) for comparison with the 30 v reference voltages which is obtained from a resistance decade \( R_1, \ldots, R_{10} \) (it is shown in a simplified manner on the drawing) of the compensation circuit. Simultaneously lamp \( L_0 \) of the display device is extinguished and lamp \( L_3 \) lights, and the difference \( U_x - U_k = 2.5 \) v is fed to the next decade which works in a similar manner.

In order to relax the requirements for the stability of the relaxation way level of operation, additional relays \( A_1, \ldots, A_{10} \) have been connected to the decade. If a main relay \( P \) (with a negative tolerance) operates at \( U_x \) which is smaller than the nominal level for this step, for instance, at \( U_x = 28.5 \) v in the above example, the negative difference \( U_x - U_k \) will operate auxiliary relay \( B_P \), whose operating level should be an order below the minimum voltmeter calibration so as to provide the required accuracy. Thus relay locks itself on operation, and through its \( KB_P \).