A distinctive feature of control operations in rotary automatic lines consists of measuring the parameters of components in the course of their continuous transportation.

Failures in the elements of typical control and sorting devices of rotary automatic lines are distributed in the following manner: for measuring transducers they amount to 91%, for the information and memory system to 3%, and for the sorting device to 6%.

The basic development should, therefore, consist of studying the reliability, precision and metrological characteristics of measuring transducers, and of working out recommendations for improving their application, and stabilizing and perfecting methods for their adjustment.

A testing automatic machine in an assembly of a rotary automatic line does not change the state or parameters of the tested components and, from a cybernetic point of view, represents a converter (Fig. 1) whose operation can be characterized by the following conditions prevailing in practice.

1. A balanced condition of the test system without any adjustment errors, but with measurement errors not equal to zero. A certain amount of satisfactory components is allocated to the "reject" group, and a certain number of defective components to the "satisfactory" group. Condition $E_0$.

2. An unbalanced condition of the test system is produced by variations in the adjustment level.

   a) An increase in the number of incorrectly rejected components. The actually defective components are not allocated to the "satisfactory" group. Condition $E_1$.

   b) An increase in the percentage of defective components in the "satisfactory" group. The "rejects" group does not contain any satisfactory components. Condition $E_{-1}$.

Thus, it is possible to distinguish four conditions in the operation of rotary test machines. Changes in the condition of the control system pass from $E_{+1}$ to $E_{-1}$, or vice versa, according to the schematics I and II

\[
\begin{align*}
& I: E_{+1} \to E_1 \to E_0 \to E_1 \to E_{-1}, \\
& II: E_{-1} \to E_1 \to E_0 \to E_1 \to E_{+1}.
\end{align*}
\]

In analyzing the schematic of variations, it is necessary to note that under actual conditions of use the ideal state $E_0$ does not exist, since the measurement errors are not equal to zero.

The flow components fed from the processing to the controlling rotary device is divided into two groups, consisting of the conditionally "satisfactory" CS and the conditionally "rejected" CR groups. The conditional qualitative structure (Fig. 2) of various assorted groups depends on the effect of metrological factors and external conditions. Group CR comprises unsatis-
factory production RR with parameters outside tolerances, and a part of satisfactory components SR whose allocation to the CR group is due to the existence of adjustment and measurement errors. Additional sorting carried out manually or by means of rotary or automatic controlling devices separates the finally rejected components FR from the repairable rejects PR whose dimensions are close to the specified tolerances. The subgroup SR detected as the result of repeated sorting is fed to the satisfactory production flow of the subsequent (processing) rotary device. The small size of the SR subgroup does not involve organizational or economic difficulties in its reprocessing.

The precision of the control-device operation is determined by the coincidence of the actual dispersion field of the components' dimensions and the specified tolerances, and is a function of the precision in the adjustment and operation of the measuring transducers. For an ideal adjustment and a symmetrical distribution law of measurement errors (a normal distribution law is assumed for manufacturing, measurement and adjustment errors), the quantitative deviations from the output structure of controlling rotary machines can be evaluated from the equations

$$q_{SR} = 0.5 + \Phi(z_1) + k_0 \left[ \Phi(z_2) - \Phi(z_1) \right],$$
$$q_{RS} = 0.5 - \Phi(z_1) + (1 - k_0) \left[ \Phi(z_2) - \Phi(z_1) \right],$$

where $q_{SR}$ is the number of satisfactory components in group CR; $q_{RS}$ is the number of rejects in group CS; $\Phi(z_2) > \Phi(z_1)$ are the normalizing Laplace functions

$$z_1 = \frac{\bar{x} - \bar{x}_m - 3\sigma_c}{\sigma_m}, \quad z_2 = \frac{\bar{x} - \bar{x}_m + 3\sigma_c}{\sigma_m};$$

$k_0$ is the normalizing factor, $k_0 \approx 0.5$; $\bar{x}_b, \bar{x}_m, \sigma_m$ and $\sigma_c$ are the distribution law parameters for measurement errors and control methods.

Mechanical vibrations of the control-transducer moving elements are the basic reason for unstable operation of the controlling rotary machines. These vibrations reduce considerably the reliability of their functioning. Investigations have shown that the number of components in the "rejects" group can be evaluated from equation

$$q_{RR} = \frac{1}{k_0} \cdot \frac{A_P}{A_0} \cdot q_{RR}. \quad (3)$$