A classification of methods of increasing the productivity of continuous monitoring of articles is given. Two ways of solving the problem are presented. A brief description is given of new methods, based on the use of the group properties of the articles being monitored, and their features and practical examples are described.

Key words: monitoring, method, single article, batch, group properties.

The problem of increasing the productivity of monitoring is especially important since it is directly connected with the solution of two important problems which arise in manufacturing: increasing productivity and the quality of its results. This directly involves methods and instruments for testing as sections of the technological part of industrial production.

Below we will only be concerned with continuous monitoring, and we will only consider the discrete product of production, for which we can introduce the idea of a batch of articles and its volume.

Productivity in any technological system is expressed by the number of articles produced in a certain period of time [1]. The process of monitoring a set of articles can be divided into the preparatory stage and the monitoring stage. The preparatory stage includes stages related to the articles being monitored and to the monitoring equipment. The main stages, which relate to the articles, are their preparation for monitoring and assembly into batches. Moreover, here we can also introduce the stage of information preparation, namely, the collection and processing of information on the surface characteristics of the articles being monitored, which can be used for subsequent monitoring, and the a priori estimation of the quality of groups of articles using the parameters being monitored, including also the results of the monitoring of previous batches, which in fact provide information feedback to the monitoring system. Such information preparation can considerably increase the productivity of monitoring and simplify both its process and the construction of monitoring equipment.

For independent tolerance, one can monitor each parameter separately. For dependent tolerance, multiparametric monitoring can be used.

In this case, a decision on the suitability of an article from the point of view of a given parameter is taken after information is obtained on other parameters of the article being monitored, on which the tolerance on a given parameter depends, or after measuring the parameters of other articles or units, which are in the same dimensional circuit with the parameter being monitored, for example, for selective assembly of the article being monitored with others. If all the parameters are monitored in one piece of equipment, one can talk of the productivity of the monitoring of this equipment. If the parameters are monitored in different equipment, it is better to consider the productivity of the equipment system as a whole, since the final result on the suitability of an article can only be obtained after all the monitoring processes have been completed.

From the point of view of the completeness of the monitoring of a batch of articles, one can distinguish two main versions of the problem considered, which are encountered in practice. The first version is the most widespread and is the well-known problem of monitoring a batch of articles in the minimum time. In this case, the condition for the process to be
completed is completion of the monitoring of all batches of the articles, and the most important parameter for production becomes the productivity of the monitoring of a batch.

The second version, which is seldom encountered is the selection from a given batch of articles of a specified number of suitable ones in the minimum time. Here the condition for the monitoring process to be completed becomes the selection of a specified number of articles, recognized as suitable, where the completion of the process does not necessarily coincide with the completion of the monitoring of all the batches of articles. In this case, we can speak of cyclic productivity but not the productivity of the monitoring of a batch of articles.

In practice, other problems of monitoring batches of articles are encountered. Monitoring in mass production with frequent change of the nomenclature of the articles produced, which is characteristic for a considerable part of modern production, is particularly important. This is the problem of monitoring a certain set of batches of different articles, close in their characteristic features and in the parameters being monitored, which, as a rule, lie in a single dimensional range. They can sometimes be monitored by one and the same monitoring instruments by readjusting the latter. Here the idea of productivity also remains valid for a set of batches if the readjustment time is included in the monitoring time. An additional productivity characteristics then arises, namely, the time taken to readjust on another batch of articles. In practice, in such cases one usually speaks not of the productivity of the monitoring but the time taken to monitor a given set of batches of articles, in which case the readjustment time is considered as a separate parameter, characterizing the monitoring equipment.

When we are concerned with increasing the productivity of monitoring, we can extend this idea by including in it the replacement of destructive testing by nondestructive testing, and monitoring of parameters which, for various reasons, were not previously monitored. We can assume formally that the initial productivity of this monitoring was equal to zero.

Fig. 1. Classification of methods of increasing monitoring productivity.