The most common existing method of recording vibrograms comprises a "transducer-amplifier-oscillograph" circuit. A typical vibrogram is shown in Fig. 1. The decoding of such vibrograms, i.e., the evaluation of the frequency and amplitude of each harmonic comprising the complex oscillation is a labor-consuming and complicated operation. The technique of processing such recordings is described in the greatest detail in [1]. The analysis of vibrograms does not present any difficulty only in the simplest cases, when the studied oscillations contain only one or two harmonics. With only three component harmonics, the problem becomes more complicated, and precise analysis requires careful processing, highly qualified experimenters, and considerable expenditure of time.

The complicated mechanical vibrations of actual objects include not only purely sinusoidal components, but also random aperiodic oscillations of most varied frequencies. They complicate still further the analysis and increase the errors in processing vibrograms.

Mechanical, optomechanical, and optoelectrical analyzers [2,3] and methods of numerical analysis [4] are not being widely used in processing such vibrograms, since these instruments and methods are only suitable for analyzing periodic functions which have a harmonic spectrum.

The range of analyzers produced by our industry is very limited and, therefore, the processing of vibrograms in vibrometric laboratories of our plants is carried out, as a rule, manually.

In many engineering plants, extensive experimental material accumulates annually in the form of innumerable vibrograms, yet in the majority of cases this valuable material is not used effectively, since the time spent on its processing cannot be justified, owing to the low precision of decoding.

The authenticity of results depends on the qualifications and experience of the experimenters carrying out the decoding.

In order to ascertain how large the errors in decoding complicated oscillations can be, we carried out the following experiment. Recordings were made of various complicated oscillations which contained from two to seven harmonic components. Each component of a complicated oscillation had a known frequency and amplitude (the evaluation of phases was not included in the object of the analysis).

The complicated oscillations were synthesized by means of an appropriate number of type ZG-10 generators 1, 2, and 3, the amplitude of various harmonics was measured on type V3-2A tube voltmeter 4 in a circuit shown in Fig. 2. Such a method of connecting several generators to a common load ensures reliable decoupling, i.e., independent operation of each generator, thus making it possible to produce complicated oscillations of any composition. Independent operation of the generators is ensured provided that the internal resistance of each generator is considerably smaller than its decoupling resistance (equal to 500 kΩ) in
Fig. 2), and that the latter does not exceed the input resistance of the analyzer [5]. Each harmonic can easily be checked by providing an attenuation of 40-50 dB for the remaining generators by means of their output potential dividers.

The ŠO-7 cathode-ray oscilloscope 5 is used for observing complex oscillations and their components at the input of analyzer 7, whereas type ŠO-7 oscilloscope 6 is used for visual observation of the separate component amplitudes at the output of the analyzer. The recording of complex oscillations at the analyzer input was made by means of loop oscillograph 8, and the recording of the spectrogram at the analyzer output with loop oscillograph 9.

The decoding of normal vibrograms (Fig. 1) was made in the vibrometric laboratories of two plants according to the existing techniques for processing vibrograms. The results of manual decoding of vibrograms are given in the table side by side with an automatic analysis of the same oscillations. The picture of a spectrogram obtained by automatic analysis is shown in Fig. 3.