The precision dilatometer DKS-900 (kinematic arrangements by P. G. Strelkov), which is mass-produced at the Khar'kov Plant Pribor, can be used for measuring with high precision the temperature coefficient of linear expansion. The dilatometer's measuring device is shown in Fig. 1.

The base 1 of the measuring device is rigidly connected to the massive dilatometer plate, which is set with a spirit level. This base carries the invar bracket 2 and two invar posts 11, which support the quartz tube 8 with its stage 8. The tapered ends of the steel roller 4, which carries the plane-parallel mirror 3, are inserted into the ruby bearings 10 of the bracket. The elasticity of the bracket ensures an easy and backlash-free rotation of the roller in its bearings.

This construction of the measuring device ensures that the roller with the mirror is maintained in a horizontal position and does not slide down with vibrations and shocks [1].

The magnet 5, which is rigidly connected to the lower end of rod 7, is attracted to the roller side diametrically opposite to the mirror. The upper end of the rod rests against the tested specimen 9, which is placed on the stage 8. The forward movement of the rod and the magnet due to the specimen's expansion with heat is converted into a rotation of the roller with the mirror. The mirror then reflects the shadow mark onto the focal plane of the autocollimator tube, where it is displaced proportionately to changes in the specimen's length and is measured by means of an eyepiece micrometer MOV-1-15x.

The rotation of the mirror through the angle \( \varphi \) displaces the image of the mark by \( \Delta n \) graduations of the micrometer scale. It can be easily shown that the lengthening of the specimen can be represented by the equation

\[
\Delta l = A \cdot \Delta n, \tag{1}
\]

where \( A = d \cdot m / 4F \); \( d \) is the roller diameter; \( m \) is the eyepiece micrometer scale value; \( F \) is the focal distance of the autocollimator tube objective.

The value of \( A \) corresponds to changes in the length of the specimen, which displace the shadow mark by one division of the micrometer scale. For \( d = 1.60 \text{ mm}, m = 0.01 \text{ mm}, \) and \( F = 400 \text{ mm} \) the value of \( A \) is \( 1 \times 10^{-5} \text{ mm} \).

The dilatometer DKS-900, owing to the above-mentioned special design feature of its measuring device, reacts but little to external shocks and vibrations; therefore, it need not be fixed to a main wall of a building, but can be placed on the floor.

The optomechanical system of dilatometer DKS-900 does not contain a prism holder with its inverting prism, which is a source of additional errors [2]. In cases when the shadow mark is deflected beyond the eyepiece microscope's field of vision, it is returned to its initial position. For this purpose an invar adjusting screw is provided for supporting the eyepiece end of the autocollimation tube.

The dilatometer frame carries a lifting mechanism's vertical guide, over which a reversible motor smoothly drives up and down a thermostat provided with a self-centering grip for holding a protective quartz hood. The frame also carries an electrical circuit for maintaining the temperature automatically at a given level, as well as a potentiometric circuit for measuring temperature.

The dilatometer DKS-900 has a temperature range of 20-900°C. The temperature is measured by means of a platinorhodium-platinum thermocouple with a multiflex galvanometer and a low-resistance potentiometer. The root-mean-square error in measuring the temperature of the specimen does not exceed 0.9°C in the range of 20-300°C, 1.0°C in the range of 300-600°C, and 1.2°C in the range of 600-900°C.

The vertical and radial projections of the temperature gradient in the dilatometer's operating zone are controlled by a differential platinorhodium-platinum thermocouple. The value of the vertical component does not exceed 0.5°C, and that of the radial one, 0.2°C.

The specimen can have a height of 2 to 20 mm and a diameter up to 10 mm. The surfaces at which it touches the stage 8 and the rod 7 must be plane and parallel.

The specimen's temperature is maintained in the thermostat automatically with an error of 0.1°C. This is provided by a stabilization circuit [3] which consists of a galvanometer unit, a relay unit, and a dc bridge. One of the bridge arms is an electrical temperature transducer consisting of 0.08-mm platinum wire. The external surface of the thermostat muffle has a triple thread. One of the threads carries the temperature-transducer platinum wire, and the other two the heater wire. Such a design provides a reliable electrical insulation between the platinum wire and the nichrome heater and their close location on the outer wall of the thermostat muffle. The advantage of such a relative position of the wires consists of the fact that it provides the possibility of repairing the heater or the temperature transducer independently of each other.

The above control circuit and thermostat do not differ in principle from P. G. Strelkov's pointer galvanometer relay and thermostat [4]: they differ only in construction.

Dilatometer DKS-900 is convenient to use; it has small overall dimensions and a modern finish. It is intended for testing the heat expansion of materials which do not interact with air over the entire temperature range; therefore, it is not provided with a cumbersome and expensive gas supply [5].

The dilatometer DKS-900 can be used for investigating specimens of materials under continuous heating or cooling in the same manner as, for instance, in the Chevenard or DKV-1 dilatometers with, however, the speed of temperature variations being set by hand.

The dilatometer DKS-900 is tested by means of reference 2nd grade specimens made from quartz or corundum monocrystals [6].

In processing the measurement results obtained with this dilatometer it is necessary to apply corrections for the expansion of the instrument and of the fused quartz from which the measuring system is manufactured.

In practice the expansion with heat of the quartz rod and tube with its stage are never fully compensated, so that, in measuring the working zone temperature, the dilatometer records its own expansion, if either it carries a specimen of quartz glass, or it has no specimen, but the rod is lowered onto the stage. The dispersion of the points on the instrument's expansion graph (with the temperature changes in the lower part of the measuring device taken into consideration) does not exceed three divisions on the eyepiece micrometer scale. Corrections for the thermal expansion of fused quartz have been taken from G. W. Kaye's review [7].