HIGH-ACCURACY MEASURING INSTRUMENTS AT THE "AUTOMATION-69" EXHIBITION

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At the special international exhibition "Modern Means for Automation of Industrial Processes" named "Automation-69" and held on May 14-28, 1969, at Sokol'niki in Moscow, high-accuracy instruments and test sets designed at various metrological institutes were demonstrated in a special section of the Soviet Pavilion in the form of an artistically decorated demonstration unit located at the center of Pavilion No. 9.

In this section, termed "Standard and High-Accuracy Instruments," some fifty instruments and sets were demonstrated by the various metrological institutes for measuring four groups of quantities: pressure, lengths and angles, temperature, and electric and magnetic quantities.

Some of these instruments are briefly described below.

Among instruments for pressure measurements there was a group of standard loaded-piston gauges for high-accuracy measurement of gauge, absolute, and barometric pressure, as well as pressure differentials.

High accuracy and sensitivity of these instruments has been obtained by using as primary measuring element an unsealed piston pair in which dry friction between moving parts has been eliminated. In virtue of the above advantages, loaded-piston instruments are widely used in certifying and scientific institutions. They are included in the more important stages of control systems that regulate the transfer of units of measurement from national standard measures to standard and technical measuring means.

The accuracy, sensitivity, and other characteristics of these instruments correspond to the latest achievements in the entire world. This group includes:

- the MP-2.5 standard loaded-piston gauge for measuring gauge pressure in the range from 0 to 2.5 kgf/cm² (0 to ~0.25 MN/m²) with a maximum error of ±0.02% of reading;
- the MAD-2500 standard loaded-piston absolute-pressure gauge with a range from 1 to 2,500 mm Hg (133 to 333,300 N/m²) with a maximum error of ±0.02%;
- the BP-1u standard loaded-piston barometer for measuring barometric pressures to within ±0.005%;
- the VP standard loaded-piston vacuum gauge with a range from 0 to 700 mm Hg (0 to 93,325 N/m²) with a maximum error less than ±0.02% of reading;
- the DIP-6.3-320 standard loaded-piston differential gauge intended principally for testing new differential gauges operating at high static pressures. It is capable of measuring pressure differences from 0 to 6.3 kgf/cm² (0 to ~6.2 MN/m²) at static pressures up to 320 kgf/cm² (~32 MN/m²) with an error less than ±0.1% of reading.

Taking into account the growing importance of automation in measurement and the introduction of automatic standard measuring instruments into practice, the member institutes of the All-Union Scientific-Research Institute of the Committee of Standards designed a number of high-accuracy standard automatic test sets and instruments. Two such test sets were demonstrated at the exhibition.

The AZD-0.4 automatic pressure setter is used as a reference device for providing accurate discrete values of pressure in testing and regulating membrane and mercury sphygmomanometers with a maximum range of 300 mm Hg (4000 N/m²). The error of the device does not exceed ±0.1 of the maximum range. The setter is an automatic loaded-piston gauge in which pressure is produced and released by means of electromagnetic valves.

The automatic circuit employed in the device allows three different operating modes:

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semiautomatic setting of discrete pressure values, each step being held as long as desired by the operator;
automatic setting of discrete pressure values with short stops at each scale reading;
continuous smooth increase and reduction of pressure with stops at both scale ends.

The device is capable of testing 40 instruments simultaneously. With the aid of this equipment the efficiency
of the operator is more than doubled.

Another similar set, the AZD-2.5, is also intended for testing and calibration of standard and precision gauges
for 1, 1.6, and 2.5 kgf/cm² (0.1, 0.16, and 0.25 MN/m²). The accuracy of setting is at least ±0.05%.

Both these sets can be used either under laboratory conditions or under conditions of mass production.

The group of temperature measuring instruments was represented by the instruments developed at the Khar'kov
State Scientific-Research Institute of Metrology; this group included:

The APR-67 automatic radiation pyrometer (Fig. 1) intended for measuring the electron temperature of plasma
on the basis of its heat radiation. The radiation pyrometer is used in the study of plasmatrons, MHD generators,
and gas-discharge devices. It determines the actual plasma temperature by measuring simultaneously and on the
same wavelength the brightness temperature of plasma from its self-radiation and the radiation blackness coefficient
by the reflectometric method.

Automatic correction reduces the error due to the different emissivity of plasma and blackbody by a factor of
10-15 as compared with other radiation pyrometers used for similar purposes.

The instrument is capable of measuring temperatures in a range from 1000 to 10,000°K. Its relative error does
not exceed ±5%.

The ÓOP-66 precision optical pyrometer is a monochromatic, ac-heated, disappearing-filament pyrometer.
The instrument is designed for precision temperature measurements and has four ranges with maximum readings of