The use of proportional counters with a constantly flowing working gas for measuring α and β radiations have certain advantages as compared with Geiger-Mueller and scintillation counters. Their operation is stable with less pure gases, they have a higher resolution than the Geiger-Mueller counters, they are affected less by γ-rays than the scintillation β-counters.

This article deals with several methods of utilizing proportional counters of different constructions in conjunction with commercial computing apparatus.

A 4π counter used with a PS-10000 instrument. The 4π counter [1] is used in a proportional counting condition with instrument PS-10000. The negative pulses of the counter are amplified and fed to the input of the computer. The counter is supplied with 3200 v from a high-voltage battery which is mounted on a metallic jacket-screen and consists of four sections with three GB-300 batteries in each. The type GB-300 batteries are placed on insulating block stands and fixed together with clamping pins. The high voltage is connected and disconnected by means of plugs. From the batteries the high voltage is supplied by means of cables. The amplifier circuit is similar to that of an ISS amplifier counting-rate meter. The input circuit of the amplifier is changed in the manner of its switching to the counter. In this connection attention should be paid to the isolating capacitor in the first stage grid circuit. The capacitor insulation must be very high, otherwise false pulses are produced which are added to the background of the counter. This requirement is met by capacitor type POV of 390 μf and 15 kv.

Since the amplifier consumption is small it is fed from the type PP power pack of the POS-10000 set. The working gas is made to flow slowly and continuously through the counter. Instead of pure methane we used the gas from the Moscow mains. From the mains the gas is taken through a calcium chloride dessicator to the counter and on leaving it is burnt on a low-intensity table laboratory burner. The adaptor flange should be sealed by means of an additional device fixed to the body of the counter. The characteristic of a counter operating on the Moscow mains gas was measured by means of a "soft" β-radiation (Fig. 1). The working voltage of 3200 v was chosen according to that characteristic.

Proportional counter SP-3 for instrument PS-10000. 4π counters require special preparation of the tested sample [1], hence they are unsuitable for mass laboratory measurements, and their construction does not permit their use with PS-10000 instruments. The authors of this article have made, for using with the PS-10000 instrument, a proportional counter SP-3 which provides α- and β-activity measurements with a highly effective count by means of ordinary "targets" used with butt counters.

Proportional counter SP-3 (Fig. 2) has a cylindrical nickel-plated brass cathode 1. Two connecting pipes 2 are soldered to the upper part of the cathode, one of which is connected to the gas supply, and the other serves as an outlet for the gas. Contacts 3 and 4, which carry a tungsten or molybdenum 20 to 40 μ filament, are mounted on two insulators below the aforesaid pipes.

Contact 3 is connected to an extension-piece 5, which has a jack for the recording device plug. Insulator 6 made of plexiglas components has a guard ring 7. The counter cathode is held between two plexiglas plates 8 with rubber packing.
Cell 9, which carries the measured sample, is made of perspex. When the cell is inserted or withdrawn the sealing is made by means of a device consisting of screw 10, handle 11 and rubber packing. The cell carries a nickel-plated brass plate 12 with a socket for the measured sample. When the cell is inserted plate 12 is connected by means of contacts to the counter cathode. The characteristics of counter SP-3 are shown in Fig. 3. Curves 1 and 2 characterize the measured α- and β-radiations when the Moscow mains gas flows through the gas-meter. Curve 3 corresponds to measurements of β-radiations when a mixture of methane and argon in the ratio of 1:1 is made to flow through the meter. It will be seen from these characteristics that for counting α-particles (curve 1) the high-tension power pack of the instrument can provide the required voltage. In counting β-particles the operating counter voltage is higher than the high-tension power pack is capable of providing; hence a boosting voltage consisting of one or two GB-400-0.01 batteries is provided. The SP-3 counter is connected to instrument FS-10000 by means of an extension cathode follower. The booster battery pack consists of a steel box which carries two flat batteries type GB-400-0.01 contained in a plexiglas jacket. The batteries are connected to counter SP-3 in series with the high-tension source of the FS-10000 set by means of plug-type connectors and coaxial cables. For a gas flow through the meter amounting to 1.5 to 24 liter/hr, the counting efficiency remains practically constant, only depending on the chosen operating voltage. With an appropriate operating counter voltage the counting efficiency for soft radiators amounts to 30–40%, which is several times greater than the efficiency of butt counters. The flushing time depends on the speed of the gas and for a flow of 5 liter/hr does not exceed 30 sec. The electrical capacity of the counter is 8.5 μF. Its over-all dimensions are 120 x 120 x 180 mm, and its weight is 12.5 kg.

TISS radiometer with a proportional β-counter. For checking surface pollution by β-active substances, radiometer TISS in combination with the extension transducer TCh is now being widely used in laboratory testing. Three STS-6 counters with steel cathodes are used as detectors in the TCh transducer. The efficiency of recording pollutions by β-active substances with a low energy radiation by means of this unit will be extremely small, owing to the thickness of the counter walls. For instance, it is practically impossible to record pollutions by promethium-147, sulfur-35 or carbon-14. For such measurements it is possible to adopt the TYu unit which is intended for checking pollutions of large areas by α-active substances and is equipped with a proportional air-filled counter which has a thin (0.3–1.0 mg/cm²) terylene film window. The required gas amplification in the proportional counter is obtained by supplying it with the required high voltage. The high voltage value required for registering β-particles is beyond the range of the TISS instrument. The use of a sufficiently high voltage makes the air-filled counter operate in a permanent discharge condition. The recording of β-particles becomes possible if the air filling of the TYu unit is replaced by a flow of a working gas which provides the required gas amplification coefficient at lower operating values of the voltage. The Moscow mains gas was used for this purpose. Thus, a stable and reliable operation of the TYu unit proportional counter was attained in recording β-particles.

The required high voltage is in the range of 2000–2100 v. The highest obtainable voltage in the TISS set amounts to 2000 v. Hence, an additional miniature battery GB-400-0.01 had to be used. The use of a booster battery provides the required high voltage range, improved stability and smooth setting of the working voltage. The constructional changes required in the TYu unit are small. Two pipes serving as an inlet and an outlet for the gas were screwed