Precision Fabrication in Platinum

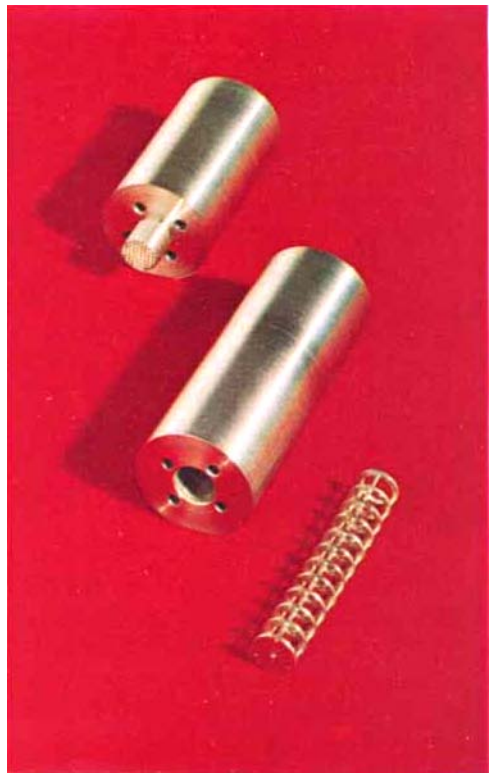
BLACK-BODY CAVITY ASSEMBLIES

The concept of the perfect black-body cavity can never be achieved in practice because such an object would have no opening in it through which observations could be made. However, providing that an opening is small enough the emission of radiation from such a cavity through the hole gives an accurate indication of the temperature inside the cavity, when a good radiation pyrometer is used to measure the radiation.

T. J. Quinn and T. R. D. Chandler have described (*Platinum Metals Rev.*, 1972, 16, (1), 2–9) work at the National Physical Laboratory aimed at compiling reference tables for platinum : 10 per cent rhodium-platinum and platinum : 13 per cent rhodium-platinum thermocouples to meet IPTS–68 with common acceptance by both U.K. and U.S. manufacturers and users. Using the N.P.L. photoelectric pyrometer they were able to check four thermocouples at a time from the gold point up to 1748°C in a black-body cavity fabricated entirely from platinum in the workshops of Johnson Matthey Metals Limited.

A similar black-body has now been made by JMM for use in Norway and this is shown in the illustration before final assembly. It consists of three parts, all of which presented special problems of fabrication. The baffle assembly is an obviously intricate piece of work, consisting of eleven platinum rings, each threaded at three points on to platinum rods, together with a terminal platinum disc pierced by the hole through which radiation is emitted.

The cylinder into which this assembly fits required the formation of four small bores, all exactly parallel to the main axial bore, to carry the thermocouples under test. It also needed a female thread at the end to be closed by the third section of the apparatus. The third section also required continuations of the four thermocouple bore holes parallel to its axis, a male screw thread on the end to be inserted into the cavity, and a non-reflective surface on the end of this insert.



The three sections forming the black-body cavity consist of a baffle assembly (foreground) with a small hole in its end-plate, a cylinder into which the assembly fits, and a stopper (background) which screws into the latter. The four holes in the cylinder and stopper accommodate the thermocouples under test

The whole piece of equipment is an instructive example of what can be done in the way of machining operations on platinum, which is sometimes regarded as not the easiest metal to work.

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