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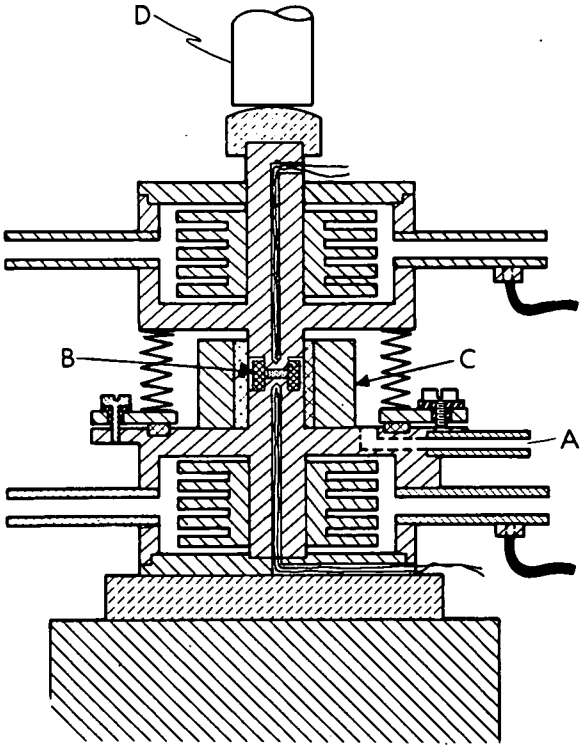
Apparatus for Measuring Electrical Properties of Materials

An apparatus has been developed for measuring the electrical properties of materials at pressures ranging from vacuum to slightly more than one atmosphere, at temperatures from 27°C to −229°C, and at contact pressures from essentially zero to over 690 kN/m^2 (100 ksi). With the apparatus, the resistivity and Seebeck coefficient of a material can be obtained simultaneously.



The two major functional elements of the apparatus shown in the diagram are a ram assembly and an anvil assembly. Each assembly is provided with inlet and outlet ports through which heat-exchange fluids can be circulated; finned heat exchangers in contact with the basic ram and anvil structures insure rapid attainment of temperature equilibrium. The anvil assembly is thermally and electrically isolated from the platform of the hydraulic press on which it is set, and the ram assembly is insulated from the piston. Both the anvil and the ram assembly are equipped with sturdy electrical connections. A bellows between the ram and anvil assemblies defines a chamber which can be evacuated or supplied with an atmosphere of fixed composition through port A.

The ram and anvil are maintained in alignment by means of concentric insulation collar B and outer support collar C; pressure is applied to the sample by the piston D. A sample is compacted between the ram and the anvil; insulation collar B prevents lateral expansion and thus defines the sample area. The ram and anvil have holes into which can be placed thermocouples to measure the temperature in the region where the sample is confined. The bellows connection between the ram assembly and the anvil assembly must be thermally and electrically insulated from one member; in the diagram, insulation is shown between the anvil assembly and the bellows attachment ring.

The resistance of a sample is measured with the aid of the usual electrical test instruments applied to the electrical contacts provided at the ram and anvil assemblies. For measurement of the Seebeck coefficient, a temperature differential is established between the ram and the anvil, and the voltage generated across the sample is detected at the electrical contacts shown in the diagram.

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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