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Apparatus for Accurate Measurement of Thermoelectric Power

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ORDINARILY, the Seebeck coefficient is measured by placing a specimen between copper blocks at different temperatures and measuring the potential difference developed across it. This method is geometrically well suited for disks, as the flat faces make good contact with the copper blocks, though oxide films can sometimes vitiate this contact and lead to substantial errors. It can give misleading results, however, when applied to cylindrical samples, as in Fig. 1, particularly if these are inhomogeneous towards the surface (as would be the case after a relatively volatile component of an alloy has evaporated away while at elevated temperatures).

In measuring the thermoelectric power of a cylindrical sample as shown in Fig. 1, most of the temperature drop will be concentrated at the regions of high thermal resistance, namely at the points of contact of the cylinder with the copper blocks, where the conducting cross section normal to the heat flow is narrowest. The Seebeck coefficient measured in this way will therefore be more representative of the surface material than of the bulk.

A further source of error inherent in this method, which affects completely homogeneous specimens as well, is the contact thermal resistance which renders the actual temperature difference across the specimen lower than that measured between the copper blocks. This leads to measured values of thermoelectric power lower than the true values. For some materials the thermal contact is so poor that, unless considerable pressure is applied through the contacts, the measured thermoelectric power can be off by as much as 50%.

The apparatus described here overcomes the foregoing difficulties by providing a longitudinal temperature gradient along a short length of any part of the specimen and maintaining substantially isothermal conditions over the remaining portions of the specimen. A very good thermal

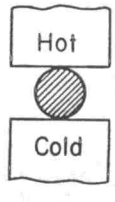

FIG. 1. Cylindrical specimen between planar contacts.

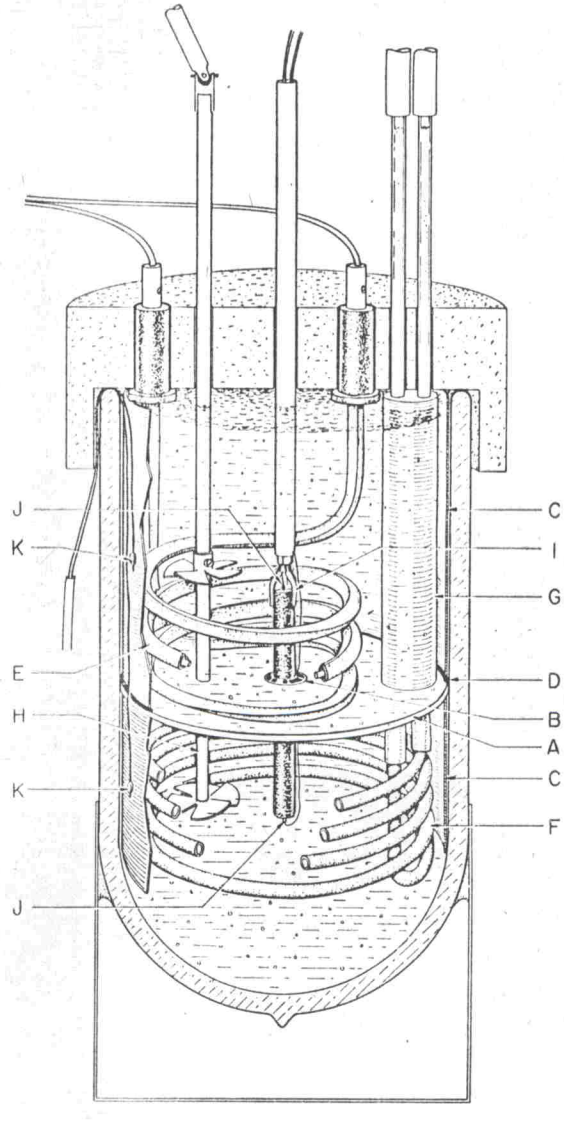

FIG. 2. Cut-away diagram of apparatus.