

IV. LOW TEMPERATURE PHYSICS

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THE VISCOSITY OF LIQUID HELIUM

Assembly of the cryostat and installation of the apparatus were completed and several experimental runs were made at room temperature in various gaseous media. Results indicated that (a) scattering is less than 3 percent and is largely ascribable to the uncertainty of the temperature, and that (b) the residual friction of the bearing is negligible when compared with the viscous torque of gases at room temperature. These runs also served to develop the technique of performing and interpreting the experiments. It was found necessary to perform measurements at night because mechanical noise in the form of sporadic tremors is excessive during the day.

The first attempt to perform the measurements in liquid helium resulted in a failure of the iron-pyrex-iron rotor that was caused by excessive shear stress at both iron-pyrex junctions and indicated that the use of pyrex would require redesign of the junctions and would, in any case, entail a high degree of risk.

A new iron-brass-iron rotor was therefore designed and a prototype of it was tested. It was found that retuning of the position-sensing circuit provided adequate sensitivity to levitate the new rotor stably at room temperature, but that the position servo could not be adjusted satisfactorily to provide stability under the changed conditions at low temperatures. The servo control circuit was redesigned completely to provide separate adjustments for the error-signal null, the error-signal gain, the derivative-signal phase, and the derivative-signal gain over a wider range than is now possible; multirange controls permit delicate adjustments to be made and restored at will.

Construction of this new circuit as well as a final model of the new rotor has been completed. The apparatus will be tested again at low temperature as soon as the large outer Dewar flask (which failed due to faulty glass) has been repaired.

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