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WIDE-RANGE CRYOSTAT TEMPERATURE CONTROL*

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Introduction

Cryostatic arrangements range from simple, thermally rather isolated objects, through immersion baths, to those for precision calorimetry. Electric controls range from manual through simple proportional, to combinations of proportional, rate and reset, employing thermocouples or resistance thermometers.

The following is a thermally rather isolated copper container, controlled by resistance thermometers and restorative electrical heating approximately proportional to the square of temperature displacement from the set point. Manual reset is required for significant change of conditions. Resistance thermometry avoids the necessity for a precisely controlled reference temperature. The apparatus was constructed for investigation of piezoelectric frequency standards. It may be useful for other electronic elements.1

Mechanical Parts

Figure 1 illustrates the construction scheme of the cryostat proper. The temperature of copper cylinder, 1, is controlled electrically. Refrigerants are placed in 3. Thermal conductivity between 1 and 3 is varied by means of a "transfer gas" in 2. Insulation for 3 is provided by a metal vacuum dewar 4, containing radiation shields, 6, surrounded when required by a liquid nitrogen shield contained in open dewar 5. The entering pipes 7, 8, 10, and 11, of thin-walled stainless steel, are arranged to provide mechanical support. Electrical connection

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Figure 1. Cryostat diagram

Figure 2. Cryostat pumping system, schematic

Figure 3. Temperature control block diagram

Figure 4. Battery switching circuit