the bomb due to internal pressure decreases the capacitor gap. This change is detected by a capacity bridge and is balanced out with an external capacity in parallel with the bomb.

The bomb capacitor is directly calibrated against the pressure readings of an external Bourdon tube gauge which measures the pressure of gaseous helium within the bomb. The calibration is done by raising the temperature of the bomb to a value such that the helium remains gaseous at the highest pressure reached. At the temperatures of calibration (about 10 to 15°K) the elastic properties of the bomb's walls are essentially temperature independent and it is assumed that the calibration is valid down to the lowest temperature of measurement.

The pressure sensitivity of the bomb capacitor depends upon the adjustment of the initial (zero pressure) spacing between the capacitor plates. In the present work, with a spacing of about 0.015 inch, the sensitivity was about 2×10^{-4} $\mu\mu$f/psi.

The assembly shown in Fig. 1 is suspended in a can filled with helium gas, and this can is surrounded by a second can immersed in liquid helium. A schematic diagram of a cryogenically similar apparatus and the method of temperature regulation have been described.[6]

Critical fields were determined by a ballistic induction method. A complete description and analysis of this method, as well as a detailed description of the Dewars, solenoids, and a cryostat substantially the same as the one used for this experiment have been given elsewhere.[9]

Temperatures were obtained in two ways. For Run No. 1 the temperature was measured using a carbon resistor calibrated against the critical field of lead at zero pressure. Calibrations were made at the beginning, at the end, and in the middle of the run which lasted for one week. Differences between the calibrations varied from 1 millidegree at 4.2°K to about 4 millidegrees at the lowest temperatures obtained. These differences introduce an uncertainty of about 0.1 gauss in ΔH_c which is about the same size as the scatter in the data, and we therefore ignore it. For Runs 2 and 3 liquid helium was condensed in the inner can and the temperature was obtained from measurement of its vapor pressure.

The experimental procedure was as follows. The inner can was raised to a temperature somewhat greater than the solidification temperature of helium at the pressure desired. Pressure was then applied to the sample by means of helium gas and a bomb calibration obtained. After the high-pressure gas inlet blocks with solid helium, the entire bomb assembly is cooled slowly allowing the helium in the pressure vessel to solidify. During the cooling the bomb capacitor is measured as a function of temperature. A typical cooling curve is shown in Fig. 2. The initial decrease in pressure of the bomb with decreasing temperature is caused by thermal contraction of the gas. A slight reduction in pressure with decreasing temperature is observed following solidification ($T<T_f$), but this causes no difficulty since the bomb capacitance can be measured at the temperature of the critical field measurements. Below 4°K the thermal expansion of solid He is negligible[10] and the bomb pressure remains constant.

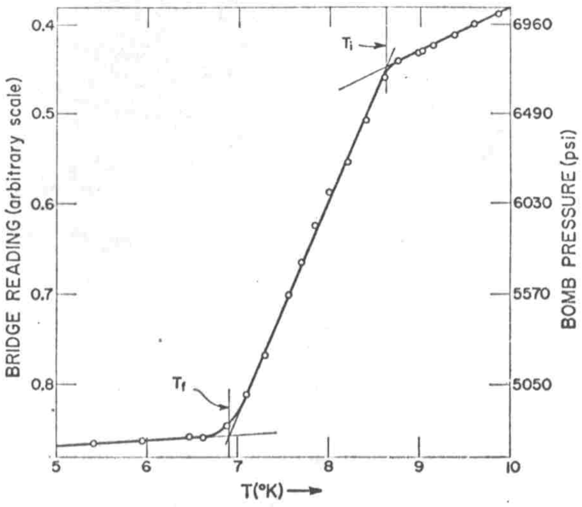

FIG. 2. Typical pressure variation in bomb during solidification of helium (which occurs at approximately constant volume). Bridge readings give the value of a balancing capacitor in parallel with the bomb capacitor. Pressure calibration is indicated on the right-hand scale.

At T_i the gas begins to solidify, with the solidification complete at T_f. In the region $T_f<T<T_i$ the helium in the bomb presumably follows the melting curve, the solidification taking place at essentially constant volume. The final pressure of the solid helium around the Pb specimen is given directly by the calibration of the bomb capacitor. However it is also possible to check the pressure obtained from the capacitor reading by using the observed value of T_f to check for self-consistency with the existing data on the thermodynamic properties of helium along the melting curve.[10] The directly measured and thermodynamically inferred values agree within about 3%.

The cooling described above is done over a period of one or two hours. It appears that this rate is slow enough so that no inhomogeneous strains are set up in the solid helium. Recent work has shown that, when subjected to inhomogeneous strain, lead exhibits large magnetic hysteresis in the superconducting transition.[11] The details of the magnetic transitions of our sample do not vary with pressure in any way. We take this fact to be a confirmation of the absence of inhomogeneous strain in

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[10] J. S. Dugdale and F. E. Simon, Proc. Roy. Soc. (London) **A218**, 291 (1953); R. L. Mills and E. R. Grilly, Phys. Rev. **99**, 480 (1955).

[11] R. W. Shaw and D. E. Mapother, Phys. Rev. **118**, 1474 (1960).