substance, and also because even in the solid phase it can be used to transmit pressure. The technique and the apparatus have been described in detail elsewhere (Dugdale & Hulbert 1957), but two important features should be emphasized here. First, the pressure is always applied, and any change of pressure is always made with the helium in the fluid state. Second, the helium is solidified and subsequently cooled at constant volume. In this way the pressure in the solid can be deduced from its equation of state (Dugdale & Simon 1953) and, in addition, any temporary non-hydrostatic stress on the specimen is minimized.

The maximum pressure at present available to us in the fluid phase is about 3000 atm and in the solid phase about 2000 atm. Consequently, since copper is relatively incompressible, the effects to be measured are small, of the order of 0·3 % resistance change under the highest pressure. Moreover, at most temperatures the temperature dependence of the resistance is considerable, e.g. the copper + iron alloy at 4·2° K has a negative temperature coefficient of almost 1 %/deg.* It is therefore clear that the temperature of the specimen must be kept very constant or, if it changes, it must be accurately measured. We have in fact used both methods. Where a suitable temperature bath was available (at the helium and the nitrogen boiling points) the high-pressure bomb was immersed directly in the liquid and true isothermal experiments were made; at other temperatures, however, the bomb was surrounded by a vacuum and the precise temperature was not controlled but measured. The former method was not very convenient at the helium point because of the need to raise the bomb temperature to the helium melting point in order to change the pressure.

The smallness of the effects to be measured determined both the method of measurement and the size of specimens. To measure the resistance we used a potentiometer accurate to $\frac{1}{10}\,\mu\mathrm{V}$. In general, the measuring currents were limited by the heating effects which could be tolerated without upsetting the thermal equilibrium between the specimen and the platinum or carbon resistance thermometer attached to the outside of the bomb. Currents of up to several hundred milliamperes were used. The minimum value of the resistance to be measured was about $0·01\,\Omega$, and so in this way we were able to secure an accuracy of resistance measurement of about 5 parts in 10^5 at the lowest temperatures. The pressures were measured by a Bourdon gauge subsequently calibrated against a pressure balance. In general, the accuracy of the measurements was limited by the accuracy of the resistance measurements, by the temperature control, or in some cases by the reproducibility of the specimens themselves.

3. The specimens

None of the specimens was heat-treated by us before measurement; all of them were polycrystalline. They were loosely mounted on an insulated copper former.

Sample I

This was a specimen of commercial copper with a residual resistance ratio, R_0/R_{273}, of $9·3 \times 10^{-3}$ (cf. Dauphinee & Preston-Thomas 1954). The impurities a-

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* This large temperature coefficient suggests that the alloy might make a useful resistance thermometer in the temperature range between 4 and 20° K.