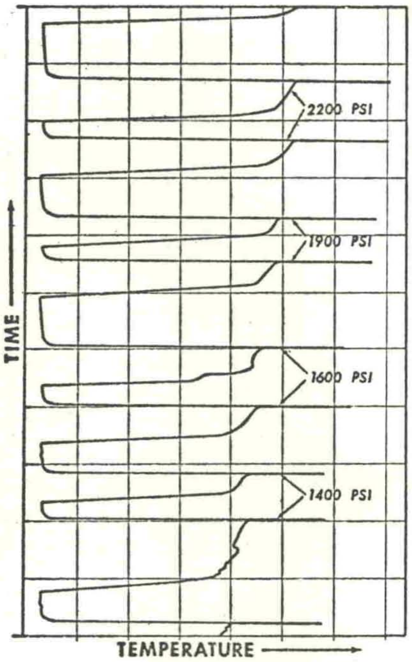

FIG. 5. Typical strip-chart record of melting.

every 6500 atmospheres, although on some runs measurements were made at about every 1300 atmospheres. (The 6500-atmosphere increment corresponds to an increment of 500 psi in the oil pressure of the hydraulic rams. This means that measurements were made at every 500 psi up to a maximum of 8000 psi, which corresponds to 105 000 atmospheres.)

Considerable variance existed in the measured fusion curves for a given substance, due to the difference in heat loss of the various samples. For example, out of the fusion curves that were measured for indium (three with graphite sleeves, two with Nichrome sleeves, and two without any sleeves, the sample being placed directly in the pyrophyllite with the thermocouple junction in the center of the sample), the measured melting temperatures at about 80 000 atmospheres were as follows: for the three with graphite sleeves, 335°C, 329°C, and 301°C; for the two with Nichrome sleeves, 308°C and 303°C; and for the two without sleeves, 336°C and 259°C. This represented a spread of about 25%, compared to the average.

In order to correct for this heat loss (due in this case to thermal conduction radially outwards from the midpoint of the sample), the following first-approximation correction formula was used:

$$t=t_m+k(t_m-t_a), \tag{1}$$

where t is the corrected temperature at the center of the sample where melting begins, t_m is the measured temperature recorded by the thermocouple, and t_a is the ambient temperature of the anvils, taken to be the temperature to which the thermocouple immediately drops just when the power is shut off after detection of a melting point. The proportionality constant k for a given sample was determined by extrapolating the fusion curve for that sample into the temperature axis, comparing the extrapolated value of the normal melting temperature with its known value, and using Eq. (1). The gratifying and rather astonishing result of applying this temperature correction to the measured fusion curves of both indium and tin was a very close correspondence of the corrected curves in each case over the entire pressure range. For example, the total spread in the corrected values of the melting temperature for a given pressure was less than 4% of the average. (Compare this to 25% for the uncorrected values.)

The largest source of error in the corrected values of melting temperature was considered to be the extrapolation involved in the temperature correction. This involved a rather arbitrary extension of the measured

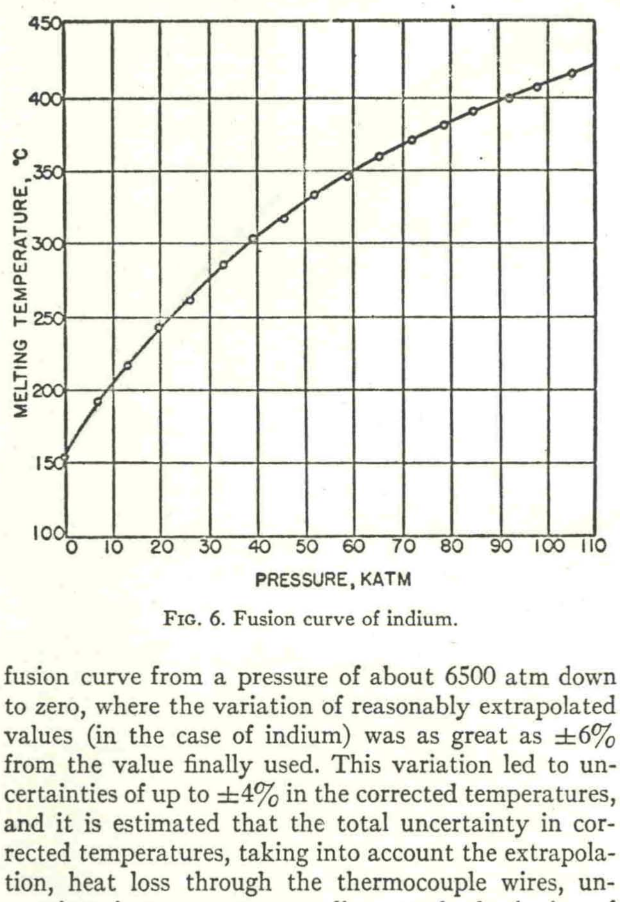

FIG. 6. Fusion curve of indium.

fusion curve from a pressure of about 6500 atm down to zero, where the variation of reasonably extrapolated values (in the case of indium) was as great as ±6% from the value finally used. This variation led to uncertainties of up to ±4% in the corrected temperatures, and it is estimated that the total uncertainty in corrected temperatures, taking into account the extrapolation, heat loss through the thermocouple wires, uncertainty in temperature readings at the beginning of the melting "avalanche," etc., is about ±5%.

RESULTS AND CONCLUSIONS

The experimental fusion curve for indium is shown in Fig. 6. It is found to rise smoothly with increasing pressure from the normal melting temperature of 156°C at atmospheric pressure to about 416°C at 105 000 atmospheres. The curve is normal in the sense of Bridgman over the entire pressure range; it is concave towards