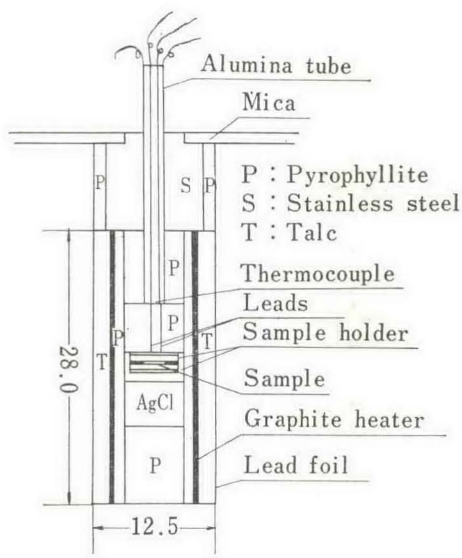

Fig. 4. The sample assembly.

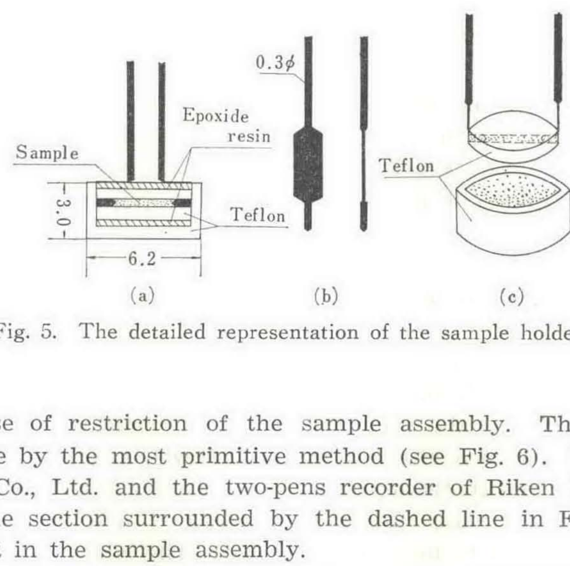

Fig. 5. The detailed representation of the sample holder.

pressure because of restriction of the sample assembly. The measurements then were made by the most primitive method (see Fig. 6). The amplifier of Ookura Denki Co., Ltd. and the two-pens recorder of Riken Denshi Co., Ltd. were used. The section surrounded by the dashed line in Fig. 6 shows the electrical circuit in the sample assembly.

The voltage V, detected on the recorder or the voltmeter, consists of the sum of the voltages due to the electrical resistances of the sample, the leads and the contacts (Rs, Rf and Rs respectively), and the thermoelectric force V_T. The sum of their electric resistances were 2 ohm at the highest. Therefore the current I was considered indeed constant within the limit of the effective number 3 in the whole pressure range in our experiments. The voltage V at given temperature and pressure then is written as

$$V=(Rs+Rf+Rc)I+V_T. \qquad (12)$$

Under atmospheric pressure, R_C is observable but never under high pressure,

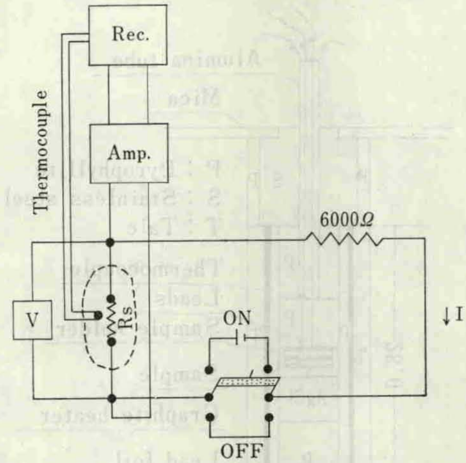

Fig. 6. The circuit observe the electrical resistances of bismuth.

because of restriction of the sample assembly. In the measurement of V in each run, however we had fused the bismuth at first and then cooled it to be solidified before measurement. Consequently Rc may be negligible compared with Rs and Rf. Eq. (12) then becomes

$$V=(Rs+Rf)\,I+V_T. \qquad (13)$$

When the on-off switch is "off", V shows V_T only as we see in Fig. 6. Hence the difference of V's in "on" and "off" gives the voltage $(Rs+Rf)I$. If RfI has been observed in advance in this manner, we can obtain RsI, that is, Rs. But the observed values of RsI's were slightly scattered in every run, hence, the observed values of Rs's were modified so as to give the correct Rs at atmospheric pressure[19) 20) 21)]. The electrical resistances of the solid bismuth as functions of pressure and temperature were observed in this manner up to 30 kb and 150°C.

We shall explain in more detail about the measurement of the electric resistances of the liquid bismuth. It must be always required to inspect leaks of the liquid bismuth in the sample holder. We could not find the leaks out of the sample holder once after every run. However the penetrations of the ilquid bismuth into the contacting faces of the leads and the hole in the sample holder are considered likely under high pressure, and if this penetrantions take place, the observed values become higher. The effects of the penetrations are considerable, in the case that the variation of the electric resistance of the sample and the quantity of the sample are small. Therefore, if the penetrations have taken place, we must modify the directly observed values to obtain the quantitative values. In our experiments, the inspections of the penetrations and the modifications were made as follows. Under a given pressure, we rise temperature and observe the voltages at 50, 100, 150, 200, 250 and 280°C, we then lower temperature and observe the voltages again at the same temperatures.

If the penetrations have occurred during this cycle, the laters are higher than the formers at the corresponding temperatures. On the other hand we