

The sample holder that was finally used is shown in Fig. 2-6. The holder is designed to push onto a four-terminal plug. The current contacts are pieces of stainless steel which fit over either end of the alkali sample and are tightened down with screws. This construction assures a large area, low resistance contact and reduces the possibility of heating at the contacts. The Hall probes are an integral part of the sample and have a width of about  $1/16$  inch. They are about  $1/8$  inch long and terminate in "ears" about  $1/8$  inch wide and  $3/4$  inch long. There are two  $3/32$  inch diameter stainless steel pins imbedded in the formica body of the sample holder; part of the formica and of the stainless steel pins has been cut away to provide a flat metal contact on either side of the holder. The "ears" of the sample are bent over the holder and clamped to these contacts by the two stainless steel plates. Thus a large area contact is achieved for the Hall leads even though the actual probes remain thin. The groove milled in the formica holder was used for forming samples of rubidium and cesium. These metals were molded till they filled the groove and then scraped until the surface was flush with the sample holder. This gave a reasonably uniform sample thickness.

In the case of lithium, sodium, and potassium, the thickness of the sheets of alkali was measured by a .001 inch dial comparator gauge. Samples varied in thickness by about  $\pm .001$  inch over their length. Since most samples were over .010 inch thick, the samples were thus uniform to  $\pm 10$  percent. In the case of rubidium and cesium, which were formed directly on the sample holder, the thickness was not measured.

We were primarily interested in the relative changes of the Hall voltage under pressure, rather than its absolute value. However, the length to width ratio in our case, approximately 3, is such that the difference between our measured voltage and the true Hall voltage is less than 1 percent. This one percent correction is computed for a geometry applicable to a semiconductor; namely, the ends of the samples are equipotentials and the Hall voltage electrodes are point probes [14]. Neither of these conditions are exactly fulfilled in our case; in particular, the finite size of the Hall probes can distort the current flow lines so that they are no longer parallel to the long side of the sample.

Non-uniformity in the thickness of the sample introduces uncertainty in the absolute value of the Hall constant, but as long as the sample geometry is unchanged under hydrostatic pressure the relative change in the Hall constant is unaffected. The sample should be flat and without "wrinkles"; for the latter can give a magnetic field normal to wrinkled portions of the surface that is less than the applied field. If such wrinkled portions straighten out under pressure, the orientation of portions of the sample is effectively changed and a spurious pressure dependence would result. Such behavior would probably make itself evident through hysteresis in the Hall voltage vs. pressure curves.

The samples were formed and mounted in a bath of Deo Base<sup>†</sup>, a light mineral oil. Rubber gloves were used in order to avoid contaminating the Deo Base with moisture. This technique was adopted after some attempts to make samples in a dry box filled with nitrogen gas. The metal surfaces remained cleaner and assembling the sample holder was easier in the Deo Base bath. In the case of lithium, sodium, and potassium a slice of metal was cut from a chunk of alkali. It was rolled into a sheet about .020 inch thick, bent over the sample holder and contacts attached. The sample was then trimmed to form the Hall contacts and the "ears" shown in Fig. II-6. The sample holder was next pushed onto the four-terminal plug and the entire unit was quickly transferred to the bomb where the pentane prevented oxidation. The film of mineral oil remaining on the sample protected it from oxidation during the transfer.

Each of the alkali metals presented some special problems of handling. Lithium was the hardest metal and was difficult to cut and roll. Furthermore, since lithium did not deform readily, it was hard to get the stainless steel current contacts to dig into the metal and form large area, low resistance contacts. This was remedied by placing a piece of sodium between the lithium and the stainless steel contact; the soft sodium made good contact to both the lithium and the stainless steel.

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<sup>†</sup> Available from Howe and French, Boston, Mass.