more slowly with magnetic field than at helium temperatures.

Non-Ohmic behavior of sample 7B was observed at helium temperatures and at pressures up to 4 kbar. This could be seen on $I$-$V$ plots at various magnetic fields. But more features can be seen on the $V$-$B$ curves shown in Fig. 10, which is a photograph of the direct recorder traces of the voltage drop (or electric field) along the sample as a function of magnetic field at various constant currents. At currents below 1 mA the resistivity rises smoothly with magnetic field. At higher currents it rises more slowly and in particular shows a slight "knee" or discontinuity in slope. In Fig. 10 the positions of the knees are seen to fall on a straight line on the plot of electric field vs magnetic field. The top portion of Fig. 10 shows a plot of the derivative vs magnetic field of the 2-mA curve. In addition to the "knee" other structure with a complicated current dependence is observed. At 1 mA no corresponding structure (or knee) in the derivative could be detected. At present we do not understand this behavior.

## ANALYSIS USING $\vec{k}\cdot\vec{p}$ MODEL

The observed variation of the electron concentration with pressure $P$ results from the pressure dependence of the energy gap $E_g$. We have fitted the $n$-vs-$P$ curve for sample 7B at 77 °K (Fig. 5) by assuming a linear pressure dependence:

$$E_g = E_0 + \alpha P \quad ,$$

where $E_0$ is the energy gap at zero pressure, $\alpha$ the pressure coefficient of $E_g$, and $P$ the applied pressure. A similar method has been used by Schmit[28] to calculate the intrinsic concentration in $Hg_{1-x}Cd_xTe$ alloys.

The concentration of ionized acceptors, $N_A'$, was assumed to be independent of pressure, and equal to $1.5\times10^{16}$ cm$^{-3}$, the value of $p$ determined from the limiting value of $R$ at high pressure. The position of the Fermi level was adjusted at each pressure until the calculated values of $n$ and $p$ satisfied the condition

$$p - n = N_A' \quad .$$

The electron concentration was obtained by numerical integration of an expression given by Harman and Strauss[29] which is based on the Kane model and includes the effects of nonparabolicity and statistical degeneracy. A value of[5] $8.4\times10^{-8}$ eV cm was used for the Kane matrix element. The valence band was assumed to be parabolic with an effective mass $m_v^*$ and the hole concentration was obtained using the standard density-of-states expression. The calculations were made for masses between $0.3m_0$ and $0.7m_0$, the range of values reported for $m_v^*$ in $Hg_{1-x}Cd_xTe$ and HgTe.[5–11]

The values of $E_0$ and $\alpha$ were adjusted to fit the calculated curve of $n$ vs $P$ to the experimental curve. The curve obtained for the two extreme values of $m_v^*$ are shown in Fig. 5. The pressure coefficient in both cases is $7.0\times10^{-3}$ eV/kbar and the values for $E_0$ are +2 and −8 meV for $m_v^*$ of $0.7m_0$ and $0.3m_0$, respectively. These may be compared with values of +11.6 and −15 meV obtained for $x=0.15$ from empirical expressions for $E_g\,(x, T)$ given by Wiley and Dexter[8] and Scott,[30] respectively. The behavior of the electron mobility shown in Fig. 6 is consistent with $E_g=0$ near $P=0$. The failure to fit the experimental $n$-vs-$P$ data well at low pressures may be due to an incorrect choice of $m_v^*$ or to the invalidity of the assumption that $N_A'$ is constant. The latter will be strictly true only if the acceptor ionization energy is small relative to $kT$, and the analysis below indicates that the acceptor energy in this sample is comparable with $kT$ at 77 °K. At higher pressure where $N_A' \gg n$, the slope in Fig. 5 is sensitive to the pressure coefficient, and relatively insensitive to the other parameters. The fitting at 77 °K should therefore yield a reliable value for $\alpha$.

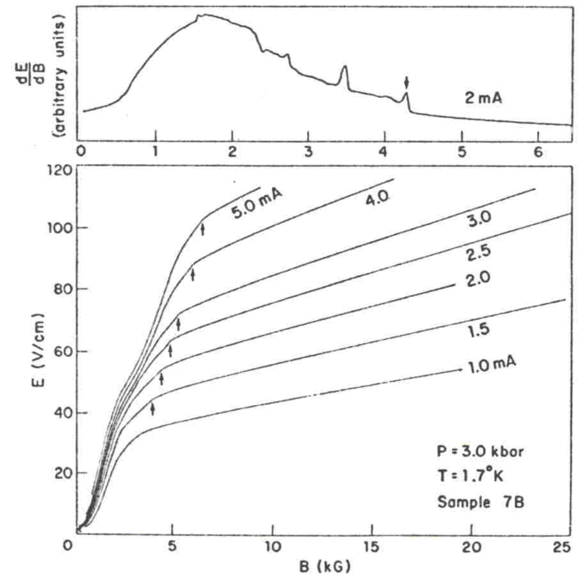


FIG. 10. Photograph of the direct recorder traces of the voltage drop (or electric field) along sample 7B as a function of magnetic field for several currents. (The sample cross-sectional area is $2.5\times10^{-3}$ cm$^2$.) The sample is non-Ohmic, since for $B>5$ kG, $E$ is not proportional to the current. In addition, structure is observed in the region $1.5<B<6$ kG for sample currents greater than 1 mA. This structure is shown on an expanded scale by the derivative curve in the upper part of the figure. "Knees" appear in the curves at fields (4.25 kG on the 2-mA curve) which mark a disappearance of the structure. These "knees" marked by arrows are seen to fall on a straight line on the $E$-vs-$B$ plot.