because they give a measure
cular orbit. This may be seen
electron of wavenumber k in

(10)

y of the electron normal to H
ngles to both v and H. Thus
rmi surface in a plane normal
orbit is thus, from equation

$$\frac{l}{eH\langle v\rangle} \qquad (11)$$

d $\langle v\rangle$ is the harmonic mean of

$$\frac{2\pi\langle v\rangle}{l} \qquad (12)$$

(9):

$$\frac{}{v\rangle} \qquad (13)$$

ber of orbits, we can in principle
surface.
t how m_c^* should change with
odel. According to this model,
roportional to S where $S^{1/2}$ is the
sure the orbits do not, except at
only size). Thus from equation

$$\frac{}{} - \frac{d\ln\langle v\rangle}{dP} \qquad (14)$$

l over the Fermi surface in the

approximation we are using here and is just proportional to k_F, i.e.,
to $V^{-1/3}$ where V is the volume of the metal. Thus:

$$\frac{d\ln m_c^*}{dP} = \frac{1}{2}\frac{d\ln S}{dP} - \frac{1}{3}\chi \qquad (15)$$

where $\chi = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T$, the isothermal compressibility of the metal.

O'Sullivan and Schirber tested this relation by measuring both the
change with pressure of m_c^* and of S (as we have seen) for the extremal
needle orbits normal to b_3. They found:

$$\frac{d\ln m_c^*}{dP} = 14\times10^{-2}\,\text{kb}^{-1}$$

compared to:

$$16\times10^{-2}\,\text{kb}^{-1}\ \text{for}\ \frac{1}{2}\frac{d\ln S}{dP}$$

(The second term on the right hand side of equation (15) is negligible).
This again illustrates the value of this very simple, nearly-free-electron
model of the Fermi surface.

We now turn to the results on cubic metals, such as aluminium and
lead. Before doing so, however, we must see how the theory can be
extended to cope with the more subtle changes in the Fermi surface
under pressure in cubic materials where the approximation we have
used hitherto would predict only a simple scaling effect.

C. THE PSEUDO-POTENTIAL METHOD

The general philosophy behind the pseudo-potential method (for a
detailed account, see for example, Harrison, 1966) is that the forces
on an electron inside an ion core are (1) a large attractive interaction
with the nucleus and (2) a complicated interaction that arises from the
presence of the other occupied electron orbitals about the nucleus. In
some cases the second part can be considered to be derived from a
repulsive potential (the pseudo-potential) which largely offsets the
attractive potential corresponding to the first force. There thus re-
mains a small effective potential which can be treated by standard
methods, for example, by perturbation theory.

9*