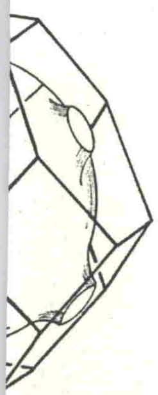
use of the contact with the
ed zone scheme are multiply

e zone boundary is usually
y from the necks are usually



face of a noble metal (schematic).
agnetic field in the [111] direction

bellies. As we shall see below
ly in gold, where the surface
ection.

out how the Fermi surfaces
essure were those of Caroline
transverse magneto-resistance
ssociated with open orbits. In
r diameter of the necks in the
the angular separation of the
magneto-resistance; they were
istortion of the Fermi surface,
in zone simply scale together
of the necks does not change.
by means of the helium gas
2 kb. Their precision was such
% per kb in Cu and 0·3% per

As we saw above, Shoenberg and Stiles (1964) introduced the modulation technique for measuring de Haas–van Alphen signals in conjunction with the use of a superconducting magnet to produce the magnetic field. In applying this method to determine the Fermi surfaces of the alkali metals they used a fixed field and rotated the specimen; in this way the signals measure directly departures of the surface from sphericity, thereby providing a very direct and sensitive technique for metals with nearly spherical Fermi surfaces. A further development came with the application of the method to determining how tension alters the Fermi surfaces of the noble metals (Shoenberg and Watts, 1965). In this work the strains involved were very small (10^{-3} or 10^{-4}, to remain within the elastic limit). The authors achieved a high enough sensitivity to measure the changes in cross-section of the Fermi surface by observing changes in the phase of the oscillation in a fixed field of about 50 kg. At this field the phase of the belly oscillations is about 10^4 and of the neck oscillations about 5×10^2. Their apparatus was sensitive enough to detect a change of phase of about $^1/_{10}$ of an oscillation, thereby making possible a sensitivity and accuracy of about 1 part in 10^5 for the belly and 1 part in 5×10^3 for the neck oscillations.

The application of this method to measurements of the effect of pressure on the Fermi surface was made by Templeton (1966). He again used the sensitivity that comes from observing a phase change in a fixed field. In his apparatus he achieved a sensitivity of about 1 part in 10^7 for the belly oscillations. To measure distortions of the Fermi surface he compared directly the relative phase of belly and neck oscillations from the [111] direction. Because of the high sensitivity of the method, Templeton could use the hydrostatic pressure (up to about 25 atm) available with liquid helium at 1·2° K. Figures 13 and 14 illustrate the two aspects of this work. In Fig. 13 we see a sequence of steps that record the change in phase of the belly oscillations in gold in a persistent field of 50 kg. Each step corresponds to an increase or decrease of the pressure by about 3·5 b. Between each step the limits of the particular de Haas–van Alphen cycle have been checked by slightly perturbing the magnetic field (without, however, permanently changing the persistent current). The results obtained in this way were not entirely satisfactory, because to calibrate the changes in phase in terms of the change in area of orbit requires the assumption that the susceptibility oscillations are truly sinusoidal. A null method was therefore used in which the phase shift produced