This is sufficient for the calculation of the neutron density within a sphere in the "final arrangement" where the disposition of material can be considered to be spherically symmetric about the center of the sphere. Thus the density of thermal neutrons in the final arrangement will be, in the inside of the sphere, given by

$$f = \text{Const.}\ \frac{1}{\varkappa r}\ \mathrm{Sh}\ \varkappa r$$
$$\approx \text{Const.}\left(1 + \frac{\varkappa^2 r^2}{6} + \frac{\varkappa^4 r^4}{120}\right). \qquad (3)$$

For our experimental arrangement, (3) is not accurately obeyed because the distribution of the neutrons may deviate from spherical symmetry. This effect will be discussed and shown not to be large enough substantially to influence our results. It will be shown, furthermore, that the validity of (1) (and hence of (3) in the final arrangement) should extend practically to the surface, i.e., that the surface effect is very small. It will be noted finally that the energy distribution of thermal neutrons is not very sharp but extends over a considerable range. This necessitates some modification of (1) and (3) which will be considered in some detail in a later report.

Our result (2) is a good deal higher than that which follows from the constants given by Fermi and collaborators, i.e.,

$$\sigma = 18 N . 10^{-24} \qquad \sigma_a = 6 N . 10^{-24} \qquad (4)$$

where $N = 2.2 \cdot 10^{22}$ is the number of atoms per cm^3. The $\varkappa$ derived from (4) is 0.35 cm^{-1}.

Discussion of Experiments with U Metal Sphere

The density of thermal neutrons was obtained from three essentially independent experiments: fission activity inside the sphere when