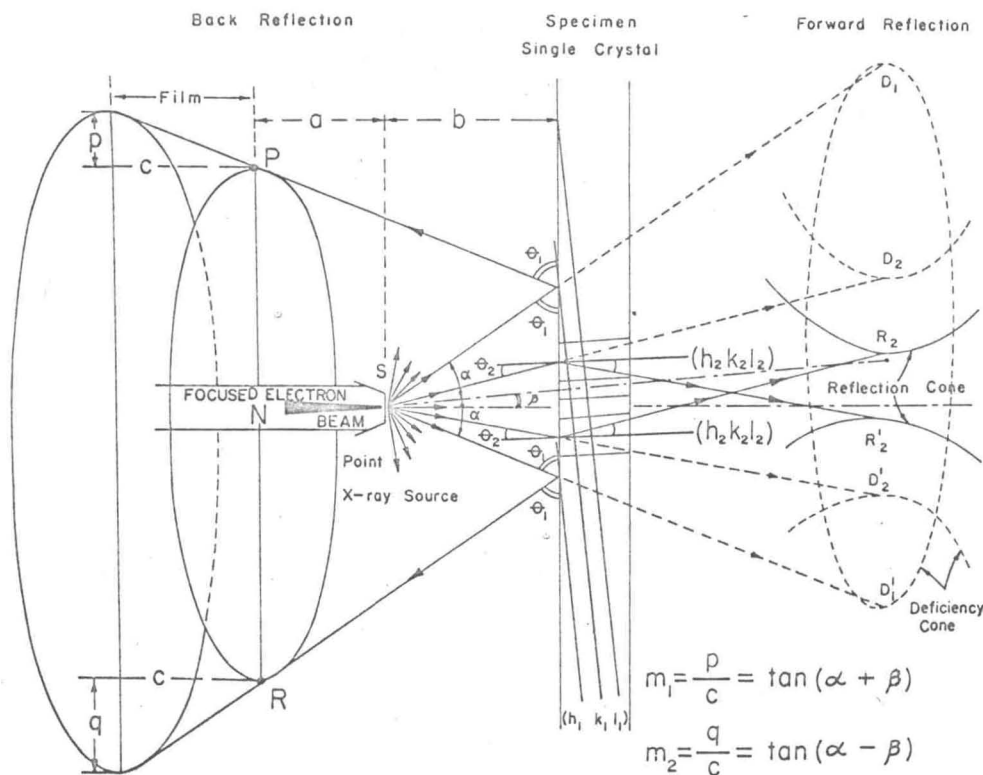


Fig. 1. Schematic representation of the generation of pseudo-Kossel patterns by the divergent beam method.



2. DESCRIPTION OF METHOD

The divergent beam method utilizes a long, horizontal x-ray tube, shown schematically in Fig. 1. An electron beam originating from an electron gun is focused by means of an electromagnetic lens onto the tip of the vacuum-tight tube closed by a thin metal foil.⁷ Since this metal foil is bombarded by the electron beam, it functions as an x-ray target. By operating the tube at a suitable voltage, an x-ray beam composed mainly of characteristic radiation emerges from the tip of the tube, exhibiting a divergence of nearly 180°. At the point of emergence the beam size is about 10 μ in diameter. When the beam impinges on the specimen, which is placed at a distance of 0.4–3 mm from the tip of the tube, diffraction patterns of the characteristic spectrum in transmission as well as in the back-reflection region may be recorded. We shall be principally concerned with the analysis of the back-reflection patterns, since these can be obtained conveniently even from thick specimens, the exposure time for a tungsten crystal being only 1 sec. The technique of measuring the back-reflection pattern, which will be subsequently described in detail, with some slight modification, equally applicable to transmission patterns.

The divergent beam patterns are analogous to the known Kossel patterns, except that the former are

produced by an x-ray source located outside instead of inside the crystal. Therefore, we refer to them as pseudo-Kossel patterns.

The diffraction cones intersect the film in ellipse-like figures (Figs. 1 and 2); and although these figures, strictly speaking, represent curves of higher orders, we shall refer to them as ellipses.

Each ellipse corresponds to a reflection from a definite (hkl) set of planes, the d spacing of which can be ac-

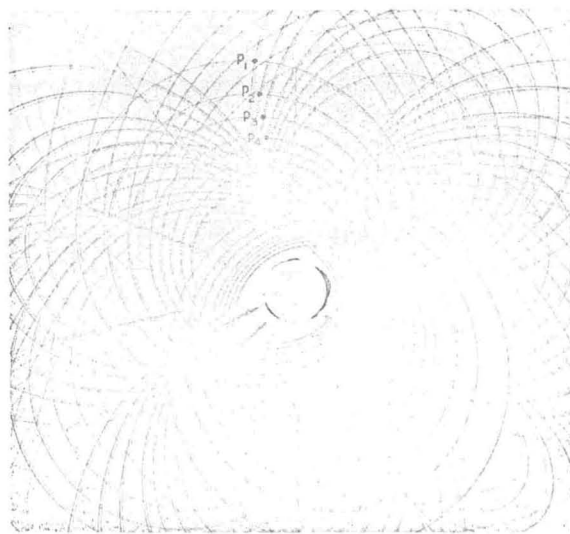


Fig. 2. Multiple exposure photograph of tungsten single crystal.

An x-ray tube of this type and a diffraction unit ("Microflex") commercially produced by the Rigaku-Denki Company, Tokyo, Japan.