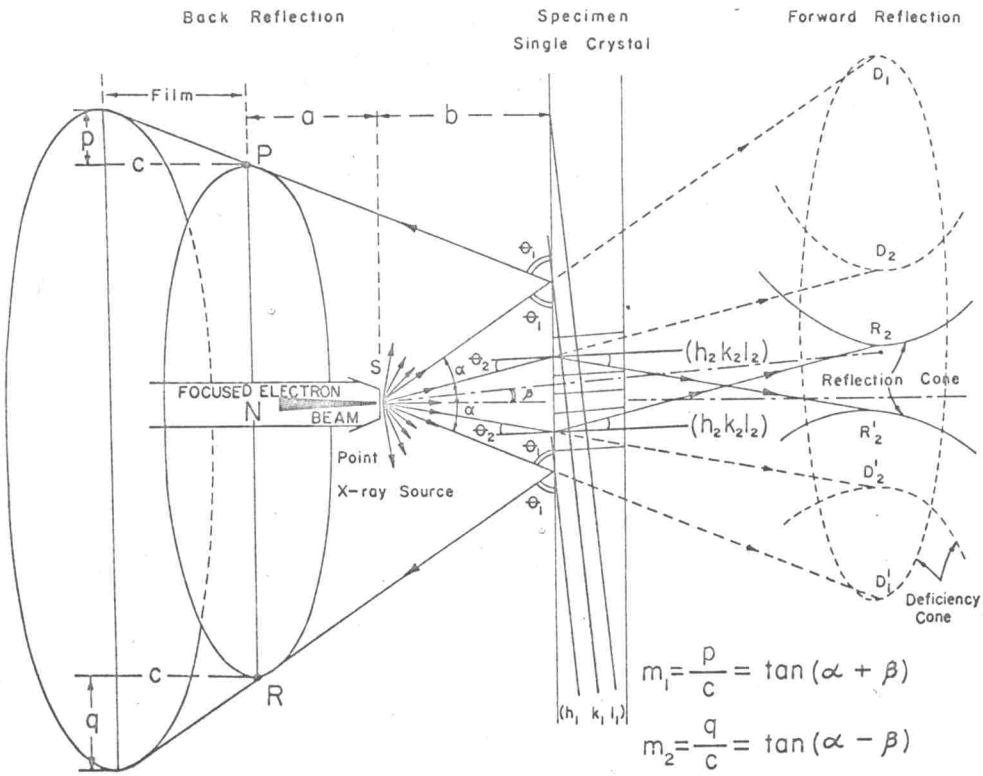

FIG. 1. Schematic representation of the generation of pseudo-Kossel patterns by the divergent beam method.

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 the 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 divergence 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 one second. 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 well-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-

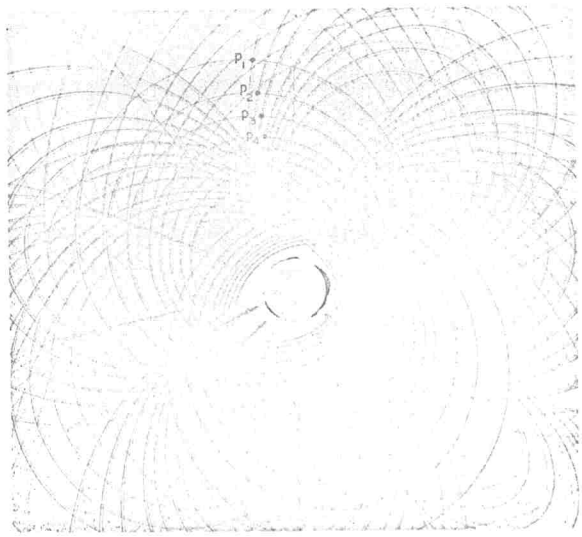

FIG. 2. Multiple exposure photograph of tungsten single crystal.

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