International Tables for Crystallography (2006). Vol. C, Figure 2.7.2.3, p. 116.

width of the ribbon incident beam. With asymmetric transmission, as drawn in the figure, $R'T' = t\sec(\theta_B - \alpha)\sin 2\theta_B$. The distance b is made as small as is permitted by the specimen shape and the need to separate the emerging $\mathbf{K}_0$ and $\mathbf{K}_h$ beams. Suppose b is 10 mm. Then, with a source S having axial extension 100 µm, the distance $a = SP$ should be not less than 0.5 m in order to keep the geometrical resolution in the axial direction better than 2 µm, and should be correspondingly longer with larger source sizes.

To take a projection topograph, the specimen CD and the cassette holding the film F are together mounted on an accurate linear traversing mechanism that oscillates back and forth during the exposure so that the whole area of interest in the specimen is scanned by the ribbon beam from P. The screen Q is stationary. If the specimen is plate shaped, the best traverse direction to choose is that parallel to the plate, as indicated by the double-headed arrow, for then the diffracted beam will have minimum side-to-side oscillation during the traverse oscillation, the opening of Q can be held to a minimum, and thereby unwanted scattering reaching F kept low. The projection topograph image is an orthographic projection parallel to $\mathbf{K}_h$ of the crystal volume and its content of diffraction-contrast-producing lattice defects. If the specimen is plate-like, of length L in the plane of incidence, then, with F normal to $\mathbf{K}_h$, the magnification of the topograph image in the direction parallel to the plane of incidence is $L\cos(\theta_B + \alpha)$. There will generally be a small change of axial magnification $(a + b)/a$ along L. The loss of three-dimensional information occurring through projection can be recovered by taking stereopairs of projection topographs. The first method (Lang, 1959*a*,*b*) used hkl, $\bar{h}\bar{k}\bar{l}$ pairs of topographs as stereopairs. One disadvantage of this method is that the convergence angle is fixed at $2\theta_B$, which may be unsuitably large for thick specimens. The method of Haruta (1965) obtains two views of the specimen using the same hkl reflection, by making a small rotation of the specimen about the $\mathbf{h}$ vector between the two exposures, and has the advantage that this rotation, and hence the stereoscopic sensitivity, can be chosen at will. When taking projection topographs, the slit P can be wider than the narrow opening needed for high-resolution section topographs, but not so wide as to cause unwanted $K\alpha_2$ reflection

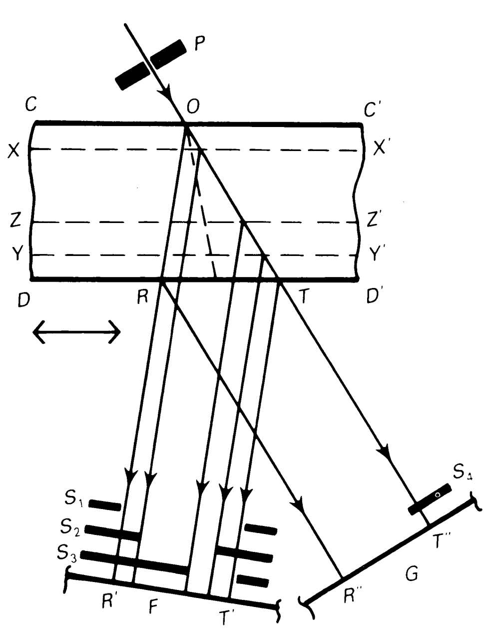

Fig. 2.7.2.3. Arrangements for limited projection topographs and direct-beam topographs.

to occur. Best use of the X-ray source is made when the width of P is the same as or somewhat greater than S.

In certain investigations, the methods of $\mathbf{K}_h$-beam 'limited projection topographs' (Lang, 1963) and of $\mathbf{K}_0$-beam section topographs and projection topographs are useful; Fig. 2.7.2.3 shows the arrangement of screens and diffracted-beam slits then adopted. The limited projection topograph technique can be employed with a plate-shaped specimen $CDD'C'$, as in the following examples. Suppose the surface of the plate contains abrasion damage that cannot be removed but that causes diffraction contrast obscuring the images of interior defects in the crystal. The diffracted-beam slit (equivalent to the opening in Q shown in Fig. 2.7.2.2), which is opened to the setting S_1 for a standard projection topograph, may now be closed down to setting S_2 so as to cut into the RR' and TT' edges of the $\mathbf{K}_h$ beam, and thereby prevent direct images of near-surface defects located between CC' and XX', and between YY' and DD', from reaching F. As another example, it may be desired to receive direct images from a specimen surface and a limited depth below it only (*e.g.* when correlating surface etch pits with dislocation outcrops). Then, setting S_3 of the diffracted-beam slit is adopted and only the direct images from defects lying between depth ZZ' and the surface DD' reach F.

To record the $\mathbf{K}_0$ beam image, either in a section topograph or a projection topograph, some interception of the $\mathbf{K}_0$ beam on the OTT'' side is needed to avoid intense blackening of the film G by radiation coming from the source, which will generally contain much energy in wavelengths other than those undergoing Bragg diffraction by the crystal. Screen S_4, critically adjusted, performs the required interception. Recording both $\mathbf{K}_0$-beam and $\mathbf{K}_h$-beam images is valuable in some studies of dynamical diffraction phenomena, such as the 'first-fringe contrast' in stacking-fault fringe patterns (Jiang & Lang, 1983). Such recording can be done simultaneously, on separate films, normal to $\mathbf{K}_0$ and $\mathbf{K}_h$, respectively, when $2\theta_B$ is sufficiently large.

When collimated characteristic radiation is used, recording projection topographs of reasonably uniform density becomes difficult when the specimen is bent. To keep the ω axis oriented at the peak of the Bragg reflection while the specimen is scanned, several devices for 'Bragg-angle control' have been designed, for example the servo system of Van Mellaert & Schwuttke (1972). The signal is taken from a detector registering the Bragg reflection through the film F, but this precludes use of glass-backed emulsions if X-ray wavelengths such as that of Cu K and softer are used. An alternative approach with thin, large-area transmission specimens is to revert to the geometry of Fig. 2.7.1.2 and deliberately elastically bend the crystal to such radius as will enable its whole length to Bragg diffract a single wavelength diverging from S, similar to a Cauchois focusing transmission monochromator (Wallace & Ward, 1975). No specimen traversing is then needed, but b cannot be made small if the wide $\mathbf{K}_0$ and $\mathbf{K}_h$ beams are to be spatially separated in the plane of F.

Quite simple experimental arrangements can be adopted for taking transmission topographs under high-absorption conditions, when only anomalously transmitted radiation can pass through the crystal. The technique has mainly been used in symmetrical transmission, as shown with the specimen $CC'D'D$ in Fig. 2.7.2.4. When the specimen perfection is sufficiently high for the Borrmann effect to be strongly manifested, and $\mu t > 10$, say, the energy flow transmitted within the Borrmann triangle is constricted to a narrow fan parallel to the Bragg planes, the fan opening angle being only a small fraction of $2\theta_B$ [see *IT* B (1996, Part 5)]. Radiation of a given wavelength coming from a small source at S and undergoing Bragg

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