of saturation in 10/120 sec., during which a H atom may be able to stay on the electrode.

The action at the cathode may be as follows: first, neutralization of the hydrogen ion or its hydrated ion with an electron from the cathode metal, and secondly, recombination of H atoms to form a molecule. Both H and D atoms accumulated at the cathode tend to diffuse back into the solution during the pauses of a , but their respective rates will be different. According to the theories of W. R. Gurney¹ and R. P. Bell², the rate of diffusion of an atom into the solution depends on the force constant of the link between the ion and the water molecule. With the increase of atomic weights, the force constant of the link or the heat of hydration becomes smaller; that is, the rate of the diffusion becomes smaller; thus, for example, the heat of hydration of H ion is 200 kcal. per gm.mol., while that of Li ion 15 kcal. per gm.mol. Therefore, the rate of back diffusion of the H atom will be higher than that of the D atom. Consequently, D may remain on the electrode sufficiently long for another D or H atom to approach it, with the formation of D₂ or HD, which will escape as a gas molecule. This process may perhaps account for a loss of D content during the electrolysis, in our case.

TSUNESABURO ASADA.
EISABURO HONDE.

Physics Department,
Faculty of Science,
Osaka Imperial University,
Osaka.

¹ Gurney, W. R., *Proc. Roy. Soc., A*, **134**, 137 (1932).

² Bell, R. P., *J. Chem. Phys.*, **2**, 104 (1934).

A New Alloy of High Density

IN an article in *NATURE* of March 20¹, Dr. C. J. Smithells describes a very interesting method of producing alloys of tungsten without melting the tungsten itself. He mixes tungsten powder together with copper and nickel powder and then heats them to 1,450° C., at which temperature the mixture sinters, the tungsten becoming embedded in a tungsten-copper-nickel eutectic. He thus avoids the technically extremely difficult, if not impossible, task of heating large masses of tungsten to melting point.

This metallurgical process is of particular historical interest, as it makes use of the principle employed by the Pre-columbian Indians of the Esmeraldas coast in South America. As I have shown^{2,3}, these Indians used the above method to produce coherent platinum; the platinum was heated together with a small quantity of gold until the melting point of the latter was reached. The platinum thus became embedded in a platinum-gold eutectic. Subsequent alternate heating and hammering produced a homogeneous alloy so resembling ordinary platinum that superficial examination will deceive even a modern metallurgist.

Copenhagen.
April 12.

PAUL BERGSØE.

¹ *NATURE*, **139**, 490 (1937).

² *NATURE*, **137**, 29 (1936).

³ Ingeniørvidenskabelige Skrifter A-44. Copenhagen.

Effect of the Penetration of X-Rays on the Resolving Power

FROM the generality of the principle of uncertainty $\Delta E \cdot \Delta t = h$, it follows that the equation for the resolving power of a grating $\lambda/d\lambda = m \cdot n$ (where λ is wave-length, m is number of rulings, n is order of the spectrum) is valid not only for the ruled grating,

Fig. 1.

but also for space-lattices. On the other hand, for example, for the ruled plane gratings used for X-rays, the resolving power is limited by the fact that it is not possible to collimate the reflected beam of X-rays. It can be shown that for the space lattices also the resolving power is limited, owing to the widening of the lines caused by the penetration of X-rays into the crystal, since the reflected beam of width w_0 is not collimated (see Fig. 1), so that the resolving power, corresponding to the number m of reflecting planes, cannot be attained.

Ag $K\alpha_2$ — — — a_1
Fig. 2.

We attempted to find the effective depth of penetration of the radiation into the crystal using the Seemann 'edge' method, only instead of sharp edges we used blunt edges of various thicknesses b , placed against the surface of the crystal. Thus, as shown in Fig. 1, we screened from the incident X-rays of glancing angle ϕ a surface portion (though mostly effective) of the crystal to the depth $h_1 = \tan \phi \cdot b$.

We used the $K\alpha$ lines of silver. By using an edge of thickness $b = 0.3$ mm. pressed against the surface of the crystal, we have screened (for silver $K\alpha$, calcite crystal $\phi = 5^\circ 20'$), a depth $h_1 = 1.5 \times 10^{-2}$ mm. With this arrangement we obtained the photograph shown in Fig. 2. Comparing this result with those obtained by means of sharp edges for this region of shorter wave-lengths¹, it can be seen that by screening a definite depth of the crystal, and thus diminishing the number of reflecting planes, the resolving power has been considerably increased (about five times).

From the width of the silver $K\alpha$ lines on plates taken at varying distances from the crystal, and by measuring the divergence of the beam $\Delta\phi = 11''$, we have calculated the width w_0 . This width corresponds