electron density between atoms is zero, indicates that the cobalt atom has of the order of two electrons more than its normal number of 27. This is in agreement with Raynor's theory[3] that in the alloys of transitional metals with aluminium, the transitional metals act as electron acceptors by filling up their atomic orbitals[4]. Also the radius of a Fermi sphere, corresponding to a number of electrons per unit volume calculated on the basis of Raynor's theory of electron acceptance by cobalt, is 1·948 A., which agrees well with the spacings of 1·959 A. and 1·939 A. of the strongest two lines on the powder photograph of Co_2Al_9.

The structure will be described in detail elsewhere.

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[2] Pauling, L., *J. Amer. Chem. Soc.*, **69**, 542 (1947).
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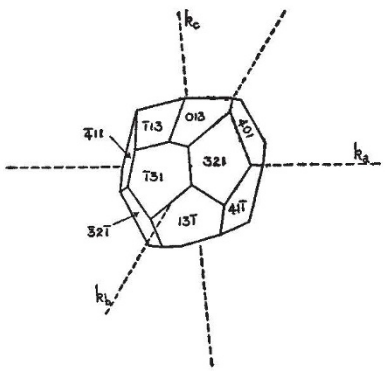
It is most gratifying to note the agreement of the results of Mrs. Douglas' determination of the crystal structure of Co_2Al_9 with the theory that, in aluminium-rich alloys, transitional metal atoms absorb electrons by filling up their atomic orbitals[1]. This work emphasizes the importance of crystallographic studies in the development of alloy theory.

Mrs. Douglas shows, in her letter, that the radius of the Fermi sphere, calculated according to the theory of electron acceptance, is in agreement with the spacings of the strongest two lines in the diffraction pattern. Since Mrs. Douglas very kindly informed us of her crystal structure results prior to publication, it was possible to make an independent examination of the Brillouin zone structure of the compound, which confirms her findings.



The strongest two lines in the diffraction pattern appear to result from the overlapping of reflexions from the ($\bar{4}11$), (321), (401), (013), ($\bar{1}13$) and ($\bar{1}31$) planes. In k-space these planes define a closed volume of the form shown in the accompanying diagram. The perpendicular distances of these planes from the origin of k-space lie between the closely similar values of 0·2543 recip. A. (for planes of the type $\bar{4}11$ and 410) and 0·2570 recip. A. (for planes of the type $\bar{1}31$ and $\bar{1}13$). Fermi spheres having these radii correspond respectively to 2·1 and 2·15 electrons per atom; the 'average' Fermi sphere, with radius equal to the mean perpendicular distance of all six planes from the origin, corresponds with 2·12 electrons per atom. The bounding planes of the Brillouin zone are therefore touched by the Fermi sphere when 2·12 electrons per atom are present. This is in very close agreement with the value of 2·125 electrons per atom, characteristic of the experimentally determined composition of Co_2Al_9 crystals extracted from aluminium-rich aluminium–cobalt alloys[2], the number of electrons per atom absorbed by cobalt[1] being taken as 1·71. These results add further support to the view that compounds of this type are properly to be regarded as 'electron compounds'[3].

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Decay of Barium-139

The isotope Ba^{139} is radioactive with a half-life of 85 min. decaying to La^{139} by β^- emission. This activity was first reported by Pool and Cork[1]. Kalbfell and Cooley[2], using absorption methods, have reported a continuous β-spectrum with a maximum energy of 1 MeV. accompanied by γ-radiation of energy 0·6 MeV., while Born and Seelmann-Eggebert[3] report a maximum β-energy of 2·3 MeV. also by an absorption method.

In the present experiments investigation of the activities was made by means of a thin-lens β-ray spectrometer and by absorption and coincidence techniques.

Ba^{139} was produced by bombarding fused barium nitrate with 7 MeV. deutrons in a cyclotron. After bombardment the barium was separated from lanthanum and sodium and precipitated in the form of amorphous carbonate. (Lanthanum activity is produced by Ba-*dn*-La reaction and Na^{24} by Al^{27}-$n\alpha$-Na^{24} reaction with the aluminium target plate.) After this separation the β- and γ-radiation both decayed with a period of 84 ± 1 min. and no contamination could be detected over five half-life-times.

Fig. 1 shows the momentum distribution of the β-spectrum obtained in the β-ray spectrometer. This

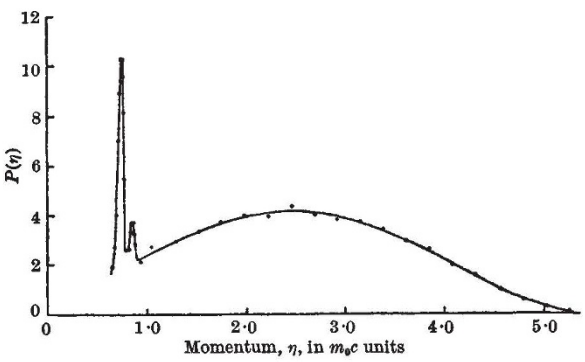

Fig. 1