Four of the CH_2 groups in the sebacic acid chain are reproduced in a two-dimensional projection (Fig. 1), and the calculated positions of the hydrogen atoms are marked with small crosses.

In the hexamethylene diamine structure the crystalline arrangement of the molecules is particularly favourable for showing the hydrogen atoms in projection.

The molecules shown in Fig. 2 lie at different depths in the unit cell, but in projection the effect is to cause the hydrogen atoms of neighbouring molecules to overlap, with a consequent doubling of the projected electron density.

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A Proposed New Form of Dielectric-loaded Wave-Guide for Linear Electron Accelerators

IT has frequently been suggested that a linear accelerator could be constructed using a wave-guide consisting of a circular metal tube lined with an insulating tube of dielectric, and several writers have recently published theoretical investigations of this type of wave-guide, as, for example, Frankel[1]. The performance of a linear accelerator using such a wave-guide is ultimately limited by the power losses which occur in the metal tube and in the dielectric itself, and calculations show that the performance compares unfavourably with other forms of accelerator, such as corrugated wave-guides[2]. However, some recent theoretical investigations show that the performance should be greatly improved by using a different form of dielectric loading, and that certain practical advantages should also ensue.

It has been shown that the losses in the metal tube can be decreased by using an anisotropic dielectric with a smaller dielectric constant in the direction of the wave-guide axis than in the transverse directions. These properties may be simulated by using a stack of isotropic dielectric laminæ in planes perpendicular to the wave-guide axis, with suitable small spaces separating the laminæ from each other. Since it is necessary to have a central hole for the passage of electrons, each lamina will be shaped like an engineer's washer, and the whole will resemble a corrugated wave-guide in which the corrugations are made of dielectric. The thickness of the laminæ and their spacing should be small compared with the wave-length in the guide in order to simulate a homogeneous material. Laminating the dielectric reduces the power losses in the dielectric itself, in addition to reducing the losses in the metal through its simulated anisotropic properties, and the total losses are found to compare favourably with those in a corrugated wave-guide.

The following table gives a few computed examples for this type of anisotropic loading:

ε	Q	ε_ρ	a (metres)	b (metres)	L_0 (metres)	η (ohm/metre)
—	—	—	0·025	0·096	11	27×10^6
100	2,000	30	0·02	0·085	100	64×10^6
95	2,000	80	0·02	0·050	17	19×10^6
16	5,000	12	0·02	0·063	100	22×10^6
16	5,000	12	0·01	0·058	100	29×10^6

where ε is dielectric constant of solid (unlaminated) loading material; ε_ρ is effective dielectric constant in the radial direction; a is radius of central hole; b is internal radius of metal tube; L_0 is length of wave-guide with an attenuation of 1·25 nepers; η, the 'efficiency' or figure of merit, is $(0{\cdot}407)\ E^2/\alpha W$; E is accelerating field; α is attenuation constant; W is energy flux in the wave-guide; $Q = \omega\varepsilon/\sigma$ for the solid dielectric. All the examples are for a wave-length of 0·25 metres. The first row relates to a corrugated wave-guide with five corrugations per wave-length and twice theoretical copper losses. The remainder are for dielectric loading, in which the Q factor shown has been taken as about half that claimed for certain ceramic materials.

The dielectric system seems to have certain practical advantages compared with a corrugated wave-guide. The dielectric washers can be made from ground ceramic material, which is relatively inexpensive, and if the spacing between washers is adjustable there should be no need to maintain the very accurate dimensions which are required in the case of corrugated guide. The outside diameter of the dielectric guide is also smaller, which should again reduce the cost of an accelerator. Finally, the design of the dielectric guide is more flexible in that widely different characteristics can be chosen. There is, of course, a number of practical difficulties which may arise; but it is not anticipated that any of these will be very serious.

It is proposed to start some experimental work at the Telecommunications Research Establishment upon dielectric loaded guides to study their practical properties.

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Surface Effects with Single Crystal Wires of Cadmium

THE letter of A. H. Cottrell and D. F. Gibbons, published in *Nature* of September 25, describes certain experiments which go to show that the phenomenon named 'thermal hardening' by Orowan[1,2], and recently investigated by C. L. Smith[3], is due to contamination by gaseous reaction. Experiments which we have been carrying out for some time on single crystal wires of cadmium have led us to the same conclusion. The surface of our *HS* cadmium wires, 1 mm. in diameter, was cleaned with great care, and single crystals were made by the method of Andrade and Roscoe[4], the wires being held in