sistent observed lines reveals a number of apparent triplets, and several triplet combinations having satisfactory intensities and the latter meeting possible inner quantum restrictions. Lacking confirmation such as Zeeman effect, these regularities seem, however, too conjectural to deserve recording at present.

MAX PETERSEN.

New York University.

The Intrinsic Fields in Ferromagnetic Substances.

FROM many points of view it seems evident that the so-called 'molecular field' introduced by P. Weiss into the theory of ferromagnetism cannot be purely magnetic. The magnitude of such a field, if responsible for the ferromagnetic phenomena, would be of the order of 10^7 gauss (in the saturated state). On the other hand, a purely magnetic field of the same order of magnitude, as W. Voigt has pointed out, is required for accounting for the enormous Faraday- or Kerr-effect in ferromagnetic substances. The study of this effect in the infra-red part of the spectrum (where the classical theory of 'free' electrons in metals is fairly valid) seems to make it probable that the so-called 'free' electrons moving between the atoms of iron or nickel are influenced by intrinsic magnetic fields of the order of 10^7 gauss. Thus two independent sources seem to make probable the existence of such enormous magnetic fields. Since both methods are, however, more or less indirect, it seemed worth while to work out a direct experimental method which could give some information as to the fields existing inside a ferromagnetic substance.

As an instrument for studying the intrinsic fields, a narrow beam of real free electrons, β-particles, was chosen. If a magnetic field exists inside a magnetised foil of nickel, it is evident that the beam of β-particles passing through the foil will be deflected. The experimental arrangement was chosen in such a way that fields of the order of 10^4 gauss (that is, fields of the order of the induction actually existing) would remain unnoticed. But fields exceeding 10^5 gauss could be easily detected by the displacement of the traces of β-particles on a photographic plate. Nickel-foils of 0·015 mm.–0·022 mm. thickness were magnetised in fields of about 500 gauss and more.

No difference whatever was detected between photographs taken using magnetised and demagnetised nickel foil. Thus it can be claimed that no magnetic field exceeding 10^5 gauss exists in a ferromagnetic substance.

Further experiments on the passage and scattering of β-particles in ferromagnetic substances are in progress.

J. DORFMAN.

Physical-Technical Laboratory,
Leningrad, Jan. 6.

Action of Magnetic Fields on the Refractive Index of Carbon Dioxide Gas.

IN NATURE of Nov. 20, 1926, p. 734, Messrs. Ghosh and Mahanti report an alteration of refractive index of carbon dioxide on applying a magnetic field of 3600 gauss transversely to the direction of propagation of the light. They attempt to explain this effect by an orientation of the molecules in the magnetic field. Now in a gas the molecules of which are orientated, if any effect on the refractive index were expected, one would naturally anticipate the primary effect would be a double refraction. Krishnan (*Proceedings of the Indian Association for the Cultivation of Science*, 10, 1. 35; 1926) has searched diligently for this effect in pure carbon dioxide over the whole range of pressures used by Ghosh and Mahanti, and his results were uniformly negative. For this reason an effect of the type described could not be due to molecular orientation. Further, the basis for the supposition of orientation in polyatomic gases, namely, the experiments of Glaser on their susceptibility, has been rendered very uncertain by Lehrer (*Ann. d. Physik*, 81, 229; 1926). Using a more satisfactory method, the latter was unable to reproduce Glaser's results. These facts made the experiments of Ghosh and Mahanti very difficult to understand, and it was considered worth while to repeat them.

Fields of 3600 and 6000 gauss were used. The carbon dioxide was prepared by heating pure sodium bicarbonate, and was dried by freezing and over phosphorus pentoxide. A Jamin refractometer was used, illuminated by the green line of mercury, $\lambda = 5461$. The compensating tube was evacuated; the other lay between the poles of an electromagnet. Carbon dioxide was admitted by a leak into the second tube, and at the same time the fringe shift was noted. In all sixty fringes passed the cross-wire for the range of pressure, 0-450 mm. mercury, as opposed to eight in the experiment of Ghosh and Mahanti. On plotting pressure against fringe-shift the same straight line was obtained whether the field was on or off, and on reduction the refractivity agreed to within one-half per cent. with the tabulated value. In fact, the results seem quite inconsistent with the parabolic curve of Ghosh and Mahanti.

E. T. S. APPLEYARD.

Cavendish Laboratory, Cambridge.

Magnetic Induction in Continuous Media.

CONSIDER a volume τ of any shape, occupied by material of unit permeability, having resistivity ρ (e.m.u.) placed in an alternating magnetic field of arbitrary distribution, sinusoidal in time, with pulsatance p. Let L specify its leading dimension. The three parameters which, together with the applied field distribution, determine the heat generated and the power dynamically conserved in the volume τ, are L, ρ, p. Then if H (e.m.u.) denotes the amplitude of the magnetic field at a particular point, the heat generated can be written

$$H^2 . L^\alpha p^\beta \rho^\gamma f\left(\frac{L^2 p}{\rho}\right) \text{ erg./sec.}^{-1},$$

where the function f depends, *inter alia*, on the distribution of H. It is supposed that the greatest dimension of the volume τ is short compared with $\frac{2\pi c}{p}$.

The argument of f is in effect the only possible adimensional combination of the parameters.

Then $L^\alpha p^\beta \rho^\gamma$ must have dimensions $L^3 T^{-1}$, and may therefore be written $L\rho(L^2 p/\rho)^\beta$ where β is arbitrary. If then we vary any two of the parameters, so as to keep $L^2 p/\rho$ constant, the power dissipated will vary as $L\rho$, $L^3 p$, $\rho\sqrt{\rho/p}$ according to the variables chosen, while for a complete variation, subject only to the above restriction, the power remains proportional to $L^2\sqrt{\rho p}$.

Variation of L has been supposed to take place by a variation of the scale of the space of τ and the field H. Variation of the power dynamically conserved obviously follows the same rules as the power dissipated.

Apparently this principle of similitude has not previously been formally enunciated.

C. R. BURCH.
N. RYLAND DAVIS.

Research Department,
Metropolitan-Vickers Electrical
Company, Ltd.,
Trafford Park, Manchester.