illusory canals had been discovered, was held quite steadily under fine seeing.

Such objections, whether considered severally or collectively, are, of course, fatal to the alleged reality of the linear markings. The planet is far too distant, from 35 to 250 millions of miles, to show canals. The truth is that a tired eye is liable to glimpse straight dark lines on the so-called continental regions of that neighbour world when viewed through an ordinary telescope; but these optical illusions vanish in a powerful instrument, which reveals broad, complex, dusky streaks, forming no network on the planet. The surface features of Mars are thus shown to be infinitely irregular and natural, like those of all the other bodies of the solar system.

Paris. E. M. ANTONIADI.
April 25.

[1] "Illusions of Vision and the Canals of Mars", in *Popular Science Monthly*, vol. 70, May, 1907.

Electron Diffraction by Vapours

DURING the last two years, a practical method has been evolved for obtaining good photographs of the diffraction of 30–55 kv. electrons by vapours. I now get satisfactory results with any substance the vapour pressure of which exceeds 10 cm. of mercury at 750° C. With the aid of the apparatus now set up, measurements of the electron diffraction of any known stable organic compounds can be made, and the investigation of many interesting structural problems arising in inorganic chemistry is also rendered feasible. A number of preliminary photographs have been taken of members of the following series and of certain other substances: Polyhalogen derivatives of methane and ethane; aromatic hydrocarbons and some of their isomeric dihalogen compounds; polymethylene dibromides from butane and decane; and volatile halides of the elements and of cyanogen.

It has recently been found that nearly double the number of diffraction rings that have been observed up to now can be registered by using a variety of photographic emulsions. Hence most of the work must be repeated before the full results can be published in detail.

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May 23.

Viscous Damping of Vibrating Metal Bars

WITH the exception of those made by K. Honda and S. Konno[1] and also those by K. Iokibe and S. Sakai[2], few measurements of viscous damping in metals have been made. I have made some experiments concerning this problem with the assistance of Mr. K. Kubo[3]. The metals experimented with were aluminium, duralumin, copper and brass, each in the form of a bar clamped at one end and free at the other. To analyse the result the appropriate solutions of the following equation were used:

$$\rho \frac{\delta^2 y}{\delta t^2} + Ek^2 \frac{\delta^4 y}{\delta x^4} + \xi k^2 \frac{\delta^5 y}{\delta t \delta x^4} + \zeta \frac{\delta y}{\delta t} = 0,$$

where E is Young's modulus, ξ the coefficient of solid viscosity, ζ the coefficient of air damping, k the radius of gyration of a cross section of the bar, and y the deflection of the bar at x.

Vibration experiments were made in a vacuum chamber of inner diameter 40 cm., inner height 24 cm., and thickness 1 cm. A circular hole of 3 cm. diameter in the vertical wall of the chamber was plugged with a disc having parallel plane surfaces, through which the movement of the test piece in the chamber was observed. The air in the chamber was pumped out through a pipe system connected to a Cenco Megavac pump and a glass Langmuir diffusion pump, by which the pressure was lowered to 1/2,000 mm. of mercury. Special arrangements for the clamping and the motion of the bar as well as the photographic recording were devised.

The results, after analysis, showed that the coefficient of solid viscosity ξ in C.G.S. units is $7{\cdot}5 \times 10^6 \sim 8{\cdot}0 \times 10^6$ for duralumin, $5{\cdot}9 \times 10^6 \sim 6{\cdot}8 \times 10^6$ for aluminium, $9{\cdot}3 \times 10^6 \sim 11{\cdot}6 \times 10^6$ for copper, and $12{\cdot}7 \times 10^6 \sim 15{\cdot}0 \times 10^6$ for brass. It was also found that the coefficient of solid viscosity is different for different amplitudes of vibration. For large amplitudes the coefficient was also large.

From this work it will be seen that the values of the solid viscosities of metals are so small as to be of the order of $10^6 \sim 10^7$ in C.G.S. units. If the energy of vibration is dissipated outwards from the clamped end, the value will be apparently increased to a much greater degree. In an aeroplane flying in air or in analogous cases, little energy can be dissipated outwards, while the inner damping is too small, so that it is probable that the phenomena of perfect resonance will frequently take place. In the case of a building or of a machine on land, the dissipation of vibrational energy is not the effect of the viscous or other frictional damping but is chiefly due to the radiation of the energy from the boundary, so that the synchronous vibration in that case does not play an important part in the nature of the building or machine. The explanation of the increase of damping with the increase of the amplitudes of vibration is somewhat difficult in the present state of our knowledge on mechanics.

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April 24.

[1] *Phil. Mag.*, **42**, 115–123; 1921.
[2] *Phil. Mag.*, **42**, 397–418; 1921.
[3] *Rep. Aeron. Res. Inst.*, Tokyo, No. 89; 1932.

Supersonic Vibrations set up in a Zinc Bar undergoing Transverse Vibrations

IN the course of experiments on the latent splitting of bars as reported by one of us[1], we noticed a very curious and interesting phenomenon in zinc.

When the zinc bar after observations of frequency

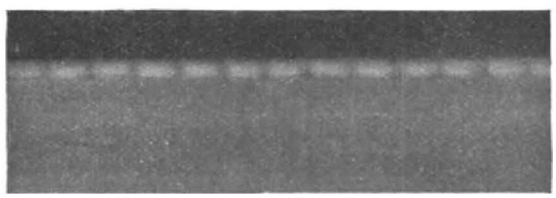

FIG. 1.

had been removed, we noticed on examining it that besides rupture lines, a large number of indentations and protuberances were clearly visible at very regular intervals along one of the vertical sides of the bar. It had the familiar appearance of the