Work on these lines is being continued, and it is hoped to publish a fuller account elsewhere later.

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¹ Darlington, C. D., and La Cour, L. F., "The Handling of Chromosomes" (London, 1942).

² Wenyon, C. M., "Protozoology", 1 (London, 1926).

³ Fry, W. B., Reports of the Sleeping Sickness Commission of the Royal Society No. XII, p. 25 (1912).

Electro-magnetic Wave Crystals

AT the conclusion of her very interesting lecture on "Diamonds, Natural and Artificial"¹, recently given at the Royal Institution, Dr. Kathleen Lonsdale mentioned past attempts at producing artificial diamonds by dissolving graphite in a molten metal at a very high temperature and letting the solution solidify under very high pressure. There is, in her judgment, strong evidence that some of the recorded attempts were successful.

I would suggest the possibility of another method of producing artificial diamonds which appears to me worth investigating, particularly in view of the much wider field which it may open.

The essence of this method consists in causing crystallization to proceed in a space filled with stationary electro-magnetic waves with the nodal points corresponding to the positions of the atoms in the crystal. It seems that in this way any feasible atom lattice can be realized, for it can be shown, on the lines which I used for determining stable positions of a rotating electron beam², that these nodal points will also be the points of maximum stability of corpuscles. Such an electro-magnetic wave pattern can be called an 'electro-magnetic wave crystal'.

The simplest electro-magnetic wave crystal corresponding to the diamond will be formed by three intersecting sets of plane stationary waves with the nodal planes determined by the sets of directional

cosines $100, \frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}$, and $\frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3} - \frac{\sqrt{3}}{3}$, and

the wave-lengths of travelling waves, propagating in opposite senses and thus forming stationary waves, 1.78 Å. and 2.06 Å. and 2.06 Å. respectively. It seems that a diamond could be obtained by solidification of carbon vapour in such an electro-magnetic wave crystal. It may be that this was actually the way in which the natural diamonds were formed, and that their rarity is due to the small probability of spontaneous formation of the corresponding electro-magnetic wave crystals.

It should be possible to extend this method to controlling the formation of any chemical compound by causing an appropriate chemical reaction to take place in an electro-magnetic wave crystal corresponding to the lattice structure formed by the atoms of the compound. For this purpose it would probably not be necessary to form a complete electro-magnetic wave crystal, in which every single atom of the compound should find its corresponding place; it might be sufficient if the crystal were to accommodate the unstable atoms of the molecule and a sufficient number of atoms of the stable part of the molecule to determine the position of the molecule. There are various possible biochemical and even therapeutic implications of this train of ideas.

The stationary electro-magnetic waves forming such crystals can be produced by interference of monochromatic beams of X-rays or by using electron diffraction. The technical difficulties involved in the construction of an apparatus for this purpose do not appear to be unsurmountable.

It is doubtful, however, whether the work of a single investigator could yield sufficient results, within a reasonable time, to provide the requisite stimulus for further progress along these general lines. I do not expect to be able to undertake anything of the kind myself in the near future, and publish the suggestion in the hope that some who have the opportunities and equipment may be inclined to follow it up.

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¹ *Nature*, 153, 669 (1944).

² *Sci. J. Roy. Coll. Sci.*, 121 (1931).

Use of the Ionization Gauge on Systems Evacuated by Oil Diffusion Pumps

THE ionization gauge is in almost universal use for the measurement of extremely low pressures, and whereas much careful work, for example, Dushman's classical experiments¹, has established its accuracy for permanent gases, very little work which throws any light on the possible sources of error when the gauge is used on systems evacuated by organic vapour pumps has been published.

Some experiments recently carried out in this laboratory have shown that, unless certain precautions are taken, the observed ionization current may be as small as one hundredth of that corresponding to the vapour pressure of the pump fluid. This result was discovered during experiments to determine the errors which would occur if a specially designed ionization gauge were used without degassing, the following procedure being adopted.

Two gauges having identical electrode structures, but with tubulation speeds of 0.7 litres/sec. and 80 litres/sec. respectively, were connected to the same vessel. The vessel, which had a volume of 10 litres and an internal surface area of 5 sq. ft., was evacuated by a standard commercial oil diffusion pump of speed 23 litres/sec. After running this pump for several hours, during which the first (or normal) gauge was ovened and bombarded to remove occluded gases, no treatment whatever being applied to the second (or high-speed) gauge, the two gauges were switched on simultaneously. Readings of the positive ion currents were then taken for a period of six to seven hours. The results of this test are shown by the curves *a* and *b* in the accompanying figure.

It will be seen that the pressure indicated by the high-speed gauge fell to a value within a few per cent of its final value within about five minutes. This is in marked contrast to the very considerable variations shown by the normal gauge, the indication of which first fell to a value just greater than 1 per cent of that for the high-speed gauge, finally increasing asymptotically to about 10 per cent of this value. It would appear logical to ascribe the high indication of the high-speed gauge to the fact that it had not been outgassed, but that this was not the case was