An attempt was made to find the positions of the carbon atoms by means of density determinations. The density of the α'-phase when containing 1·35 per cent carbon was calculated on the following three assumptions:

(1) Addition of carbon atoms	7·65
(2) Complex substitution of carbon atoms . .	7·42
(3) Simple substitution of carbon atoms . . .	7·19

A steel specimen with this content of carbon was quenched and afterwards placed in liquid air for 48 hours in order to increase the percentage of the α'-phase. The density was found to be 7·62. As shown by an X-ray photogram (Fig. 1, *e*), the specimen consisted of α'- and γ-iron, and the intensities indicate that there was more tetragonal martensite present than austenite. The density of austenite with this composition is found by calculation to be 7·94. Assumption (1) is immediately ruled out, as the densities of both components would be higher than that of the mixture. Assumption (3) has been shown above to be very improbable and would give 57 per cent γ-iron, 43 per cent α'-iron, while the X-ray intensities indicate that the α'-phase predominates. Assumption (2) gives 60 per cent α'-iron, 40 per cent γ-iron, in good agreement with the X-ray intensities.

The only suggested structure of tetragonal martensite which explains the observed density, the increase of volume with the carbon content, and the elongation of one of the crystallographic axes may be described as follows. In the body-centred lattice, groups of two carbon atoms, statistically distributed, replace some of the iron atoms. The carbon atoms are most probably orientated in such a way that the axes of the C_2 groups are parallel to the tetragonal axis of the lattice.

The decomposition of the α'-phase on tempering, as well as the reactions occurring on ineffective quenching, have also been studied, and the results obtained will be published elsewhere, with a more detailed account of the results reported here.

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A Laboratory Method of demonstrating the Formation of Fronts and Vortices when there is discontinuous Movement in a Fluid.

ACCORDING to views now generally accepted, extratropical cyclones are formed along surfaces of kinematical discontinuity between air-masses having different temperatures and moisture-contents, and during their growth they possess an asymmetrical structure. Recent studies [1] of tropical cyclones show that they also have often a similar origin and structure.

It is well known that vortices can easily be formed in a fluid by producing a sufficiently sharp discontinuity of velocity—as by suddenly moving a half-immersed spoon across the surface of water. A common method of studying stream-lines in water is by strewing aluminium powder on its surface. With water, however, the movement is so rapid that it is often difficult to follow its details. Melted spermaceti, in which aluminium powder is suspended, is a very convenient medium for the demonstration and study of fronts and vortices similar to those which occur on a much larger scale in Nature.

If a shallow layer of spermaceti is heated in a flat enamel dish over a plate of copper or brass, then, as is well known, the liquid layer is divided up into a series of small polygonal cells with liquid rising at the centres of the cells and falling at their peripheries. If, now, a cylindrical rod is moved across the liquid with its axis vertical, the formation of the Kármán double row of vortices can be distinctly seen. By substituting a thin small-angled wedge of wood with its narrow end dipping in the liquid, and moving it across the surface with its axis inclined, a wave motion is set up, and the stream which flows past the thicker end of the wedge rolls up into a succession of vortices which persist for some time before they disappear. The development of these vortices resembles in many ways the development of a cyclone by the incursion of a tongue of warm air in cold air. Fig. 1 (*a*) and (*b*) shows photographs of such waves and vortices, the area of disturbance being obviously larger in the latter case. When the liquid is at a low temperature, or when the speed of movement of the wedge is small, waves are set up without the formation of vortices, similar to those studied in the atmosphere by Bergeron and Swoboda (Fig. 1 (*c*)). By giving a circular movement to the wedge, the series of cyclones along the polar front can be neatly imitated (Fig. 1 (*d*)).

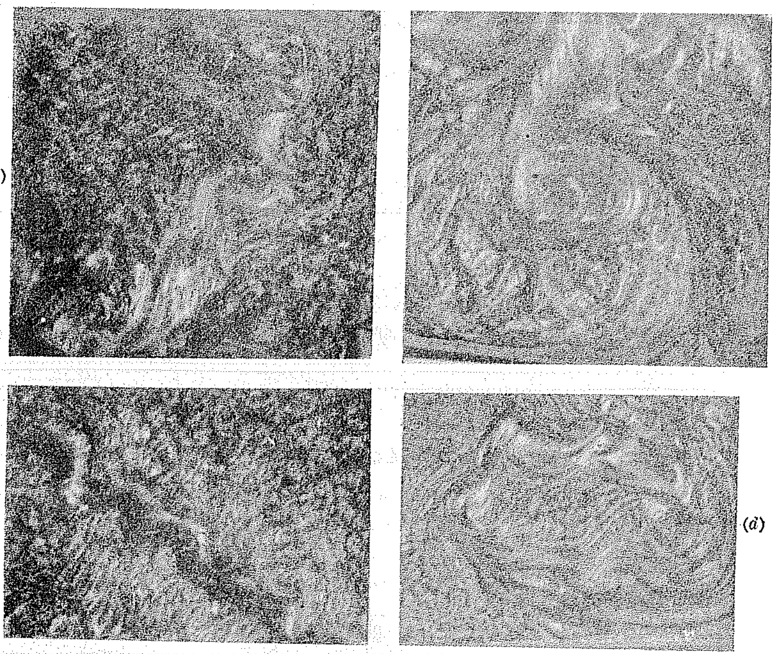

FIG. 1.

The interesting question as to how far the instability of the liquid layer helps the formation and persistence of these vortices is being examined.

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[1] K. R. Ramanathan and A. A. Narayan Iyer: "The Structure and Movement of a Storm in the Bay of Bengal during January 1929".

Nature, 127, 272, 1931.