THE experiments described in our paper have shown that small polished plates, *whether clean or contaminated by vapours or liquids*, approach within about 0·3 microns when brought gently together in a dust-free atmosphere. Clean plates showed the same separation *in vacuo*, and this distance corresponded with the known limit of flatness of the plates. Later experiments with polished glass plates up to 10 cm. in diameter have confirmed this conclusion, since, when placed together gently in the air of the laboratory, they frequently showed first order interference colours and a mean separation of about 0·3 microns. The exact separation under these conditions depended on the amount of dust present in the atmosphere, but it was seldom as great as 4 microns. There was no evidence for 'floating' either with clean or contaminated surfaces.

In Prof. Watson's experiment, two glass fibres 2·8 microns in diameter were laid on a polished steel plate and a polished steel cylinder placed on top. Instead of sinking down to within a distance of 2·8 microns, the cylinder appeared to float in the air at a height of 15 microns above the plate. After 'prolonged tapping', the air gap decreased to 6·36 microns, but the cylinder would sink no lower.

We have repeated this experiment, using glass surfaces and fibres 1 to 2 microns in diameter. When the fibres were short, there was no 'floating'; the separation was equal to the diameter of the fibres. When they were longer than a few millimetres, the separation was frequently as great as 15 microns, but an examination of the fibres showed that they were obviously crinkled. The amount of separation decreased with tapping, and depended simply upon the size of the crinkles.

It is, of course, impossible for us to say whether the same factor was or was not responsible for the large separation recorded by Prof. Watson, but, until there is some convincing evidence for 'floating', we consider that any separation between polished surfaces which exceeds the limits of flatness of the plates by more than a few molecular diameters must be attributed to something much more concrete than a mere cushion of air.

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Apparent Formation of Copper Carbonyl

AN interesting observation has been made in the laboratory of the Department of Chemistry here on the apparent formation of copper carbonyl in the synthesis of methanol using certain catalysts containing copper.

It was noted that the passage of either hydrogen and carbon dioxide, or water gas, over a catalyst containing equal parts of copper, aluminum, and zinc, produced a liquid condensate which was quite colourless when blown from the high-pressure condenser. However, in a short time, apparently dependent upon the amount of water in the liquid, an evolution of gas occurred which was accompanied by the formation of a yellowish precipitate. Qualitative tests showed that copper was the only metal in this material. The precipitate appeared to be semi-colloidal in nature and was readily soluble in hydrochloric acid, which suggests that the copper was present as a hydrated oxide. This was further demonstrated by the results obtained using hydrogen and carbon dioxide, in which case the liquid contained equal amounts of water and alcohol, and precipitation occurred almost instantaneously upon removal of the pressure. Numerous other catalysts investigated did not show the phenomenon.

The possibility of this precipitate being formed by the hydrolysis of a copper salt formed in the reaction chamber is precluded by the lack of acidity in the condensate. If the evolution of gas were due to the release of pressure, this would occur at once and not after an induction period, as was the case with the water gas condensates. It was further observed that evolution was greatly stimulated by the addition of water, acid, or alkali to the condensates; and even after boiling an alcohol condensate, evolution could be obtained by the addition of water. Such phenomena seem to indicate the presence of a compound with similar properties to those expected of a copper carbonyl.

The analysis of the gases evolved by the liquids was not particularly enlightening, due to the complications added by the solubility of the gases in the liquid. Usually about 1 c.c. of gas was given off by 3 c.c. of liquid, and the composition varied greatly. Carbon dioxide was usually high, averaging about sixty per cent, but fell as low as 10 per cent; carbon monoxide averaged about 17 per cent, but was as high as 80 per cent on one occasion. Hydrogen was invariably low, while hydrocarbons accounted for a fairly constant value of 18 per cent. Interpretation of these results is extremely difficult.

Bertrand[1] claimed the formation of a copper carbonyl at atmospheric pressure, but Mond and Heberlein[2] were unable to verify this result. In our experiments with the above catalyst at atmospheric pressure and various temperatures there was no evidence of the formation of a carbonyl. However, pressure should favour such a reaction, and the product, apparently unstable at atmospheric pressure, would decompose as observed.

The experimental results indicated that the greater the amount of copper precipitated from the condensate, the greater was the activity of the catalyst. If this compound were an intermediate in the formation of methanol, such a result would be expected.

The formation of such an intermediate and the observance of carbon monoxide in the exit gas in the experiments involving carbon dioxide and hydrogen offers a new view on the mechanism of methanol formation which will be discussed elsewhere.

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[1] Bertrand, *C.R.*, **177**, 977; 1923.
[2] Mond and Heberlein, *J. Chem. Soc.*, **125**, 1222; 1924.

Trail of Bright Fireball of Feb. 24

ON Feb. 24, at $20^h\ 41^m$ G.M.T., a brilliant fireball passed over West Lancashire from south to north and was observed by many persons who have communicated their observations to me. I did not myself see the object, as I was in the Observatory exposing a plate for experimental purposes on the nebula in Orion, but I noticed the sudden brilliant illumination of the sky and the interior of the Observatory, and made a note of the time. On developing the plate next morning I found that the trail of the meteor was recorded on it, as shown on the accompanying print (Fig. 1).

The path of the meteor is very well defined, making an angle of 35° west of north with the declination circle of the nebula at the time of passage of the meteor. The trace shows well-marked periods of incalescence, and the brilliancy was obviously increasing rapidly during the interval of passage of the object across the portion of its path recorded on the plate, which is of a length of about 8°. This appears