Since the temperature of the subsoil at depths normally encountered in civil engineering work is of the order of 10° C., it is thus necessary to make a correction for temperature when making estimates of settlement from the results of consolidation tests carried out on samples of soil at normal laboratory temperatures (say, 20° C.). Failure to make this correction can result in appreciable errors in the estimation of settlements; for example, if the laboratory tests are carried out at 20° C. and the average temperature at foundation-level is 10° C., the estimated settlement at any given time would be about 30 per cent too great. It is suggested that the neglect of this factor may be partly responsible for some of the considerable discrepancies noted in the past between calculated and measured settlements of structures founded on compressible soil.

The work described above was carried out at the Road Research Laboratory of the Department of Scientific and Industrial Research as part of the programme of the Road Research Board. This note is published by permission of the Director of Road Research.

W. A. LEWIS

Road Research Laboratory,
Harmondsworth, Middlesex.
May 26.

Ultrasonic Soldering of Aluminium

FOR some years it has been known that it is possible to tin aluminium and its alloys by subjecting their surface to the action of intense ultrasonic vibration at the same time as molten solder is applied[1-3]; but the mechanism for this effect does not seem to have been studied. We have now established that the process is one of removing the oxide skin by cavitation erosion.

A specimen of aluminium was immersed in a bath of molten solder, to which were communicated vibrations at a frequency of 18 kc./s., set up by applying 50 W. to the driver coil of a small magnetostrictor. The exact amplitude of oscillation in the bath could not easily be determined, but was adequate to tin an aluminium surface immediately at atmospheric pressure. When, however, the experiment was repeated with an ambient pressure of 4 atmospheres, tinning was completely prevented. Since the increased pressure can have had only a negligible effect on any factor other than cavitation, this seems convincing evidence of the essential part played by the latter.

Aluminium is known to have a low resistance to cavitation erosion, even in water[4], so it is not surprising that collapsing voids in molten solder will be able to disrupt the surface, exposing the aluminium underneath for alloying with the metal which is impinging violently against it in the very action of cavitation. We can expect, moreover, that the usefulness of the ultrasonic technique for tinning different 'difficult' metals will be related to their susceptibility to cavitation erosion. In the limited studies that have so far been made, this has been found to be true.

We have found that ultrasonic cavitation must be expected to be more severe at lower frequencies[5], so we should expect that ultrasonic tinning would also be more effective in this region. Most experiments that have been reported have been done at relatively low frequencies, although it has been implied that vibration at 1,750 kc./s. can facilitate soldering[6]. We have used a 1,000-kc./s. crystal to which 3 kV. (root mean square) was applied, and have verified that it was not possible to tin aluminium in a pool of molten Wood's metal resting on it, although such tinning occurred quite readily in the low-frequency bath, where the ultrasonic intensity was appreciably lower.

Thanks are due to the directors of the Mullard Radio Valve Co., Ltd., for permission to publish this note, and to Dr. C. F. Bareford, manager of the Electronic Research Laboratory, for his help in the work described.

B. E. NOLTINGK
E. A. NEPPIRAS

Mullard Radio Valve Co., Ltd.,
Electronic Research Laboratory,
Cross Oak Lane, Salfords,
Nr. Redhill, Surrey.
June 8.

[1] Fidesgesellschaft, Brit. Patent App., 15,773/39.
[2] *BIOS Rep.* 1844, Item No. 21 (H.M.S.O., 1946).
[3] Thomas, F. W., and Simon, E., *Electronics*, 21, 90 (1948).
[4] Donaldson, J. W., *Metal Industry*, 60, 383 (1942).
[5] Noltingk, B. E., and Neppiras, E. A., *Phys. Soc. Proc.*, B, **63**, 674 (1950).
[6] Sivian, L. J., U.S. Patent 2,426,650.

The Discovery of Magnesium

IN a recent little book entitled "The Story of Magnesium", issued by the American Society of Metals in 1949, the author, W. H. Gross, states (p. 17): "The discovery of magnesium is generally attributed to Sir Humphrey [*sic*] Davy in 1808. He did not actually obtain magnesium in metallic form, but merely established the fact that magnesium oxide was the oxide of a new metal. Magnesium was first isolated in 1828 by the French scientist Bussy. . . ."

Such a statement is entirely misleading, as a study of the paper read before the Royal Society by Davy on June 30, 1808, and published in the *Phil. Trans.*, **98**, 333 (1808), renders abundantly clear.

After describing his now well-known method of obtaining an amalgam using a mercury cathode, Davy states that he heated it in a glass tube from which all air had been expelled: "I found immediately that the mercury rose pure by distillation from the amalgam and it was very easy to separate a part of it; but to obtain a complete decomposition was very difficult. For this nearly a red heat was required, and at a red heat the bases of the earths instantly acted upon the glass and became oxygenated. . . . The metal from magnesia seemed to act upon the glass even before the whole of the quicksilver was distilled from it. In an experiment in which I stopped the process before the mercury was entirely driven off it appeared as a solid having the same whiteness and lustre as the other metals of the earths. It . . . quickly changed in air, becoming covered with a white crust and falling into a fine powder which proved to be magnesia" ("Alembic Club Reprints", No. 6; 1894).

Although Davy may not have succeeded in obtaining magnesium entirely free from mercury, there can be no doubt that in some of his experiments he obtained an almost pure product. Who would expect high chemical purity at the first attempt? Davy did far more than merely establish the fact that magnesia was the oxide of a new metal.

There was, of course, no 'e' in Davy's Christian name.

J. NEWTON FRIEND

134 Church Road,
Moseley,
Birmingham 13.