Acoustic Research.

THE editorial article on the subject of "Acoustic Research," in NATURE of October 28, p. 565, conveys an impression which seems to need correction.

In justice to the life-long labours of the late Prof. W. C. Sabine, now gathered into a volume of "Collected Papers on Acoustics" (Harvard University Press), it should be said that the practical problem of predicting the acoustics of an ordinary auditorium in advance of its construction, or of correcting one already built, was solved by Prof. Sabine some twenty years ago. The essential feature to be considered in such a problem is the reverberation, and Sabine's papers on this subject are full and complete. Other acoustic questions are, of course, sometimes involved, such as the transmission of sound through walls, the effect of resonance, etc. Several of these had also been the subject of prolonged experimental investigation by Prof. Sabine at the Jefferson Physical Laboratory at Harvard, but some of the results were withheld until the work could be completed. His untimely death interrupted this programme, and since then the work has been continued here, and at the Acoustical Laboratories, Illinois, under the direction of Dr. Paul E. Sabine, as described in Mr. Munby's article in the issue of NATURE of October 28, p. 575.

Architects in the United States have become aware of the importance of Sabine's results, and scores of cases could be cited in which the application of the principles worked out by him has led to complete success. The opinion that "the laws regulating the production of a successful building for hearing and speaking have yet to be worked out" implies a lack of respect for Sabine's profoundly accurate and thorough work, which I am sure no one will maintain who has taken the trouble to acquaint himself with the subject.

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November 14.

[The intention of the article to which Prof. Lyman refers was to promote increased attention to acoustic research; and we regret that a phrase in it should be regarded by him as implying a lack of respect for the pioneer work done by the late Prof. Sabine. While readily admitting the value and completeness of Prof. Sabine's papers, the continued useful activities of his acoustic laboratory would seem to indicate that in the general sense intended the expression used in reference to the need for further investigation was justified. It may be true that rules have been worked out upon which a perfect acoustic building can be constructed; the practical problem presented to the architect, however, often takes the form of the provision of acoustic success with prescribed limitation in the matter of design, and it is in this direction that further knowledge is needed.—EDITOR, NATURE.]

Separation of the Isotopes of Zinc.

PURE zinc has been subjected to distillation in a high vacuum, and after three fractionations of the distillate the latter shows a lower density than the original zinc. The residue has been reduced by evaporation to one-twentieth of the original volume and shows an increased density. The method of separation is similar in principle to that of Brønsted and Hevesy for mercury.

Two sets of distillations have been carried out. In the preliminary set, last winter, the distillations of the distillate were carried out too rapidly and too great a quantity was distilled. The results for the distillate indicated no separation, whereas the separation of the residue, which was effected under better conditions, showed an increase in density. Another set of distillations was therefore carried out this summer under improved conditions (using liquid air condensation and a more careful regulation of the temperature and the quantity distilled). The final distillate is lighter and the final residue heavier than the original zinc. The determination of the density of a metal, as ordinarily performed, is no criterion of the average atomic mass per unit volume. The main part of the work has therefore been directed towards making it so; the only alternative appears to be the determination of the atomic weight to an accuracy of about 1 part in 10,000. The presence of flaws, of impurities, of allotropes, and of metal in a different physical state do not sufficiently explain the results; the discussion of these four points will be included in the publication of the work.

Taking the density of the initial zinc as unity, the density of the distillate is 0·99971, and of the residue 1·00026. These numbers appear to be outside the error of 14 determinations of the density of 7 separate samples of the initial material, for the greatest divergence between the numbers obtained only amounts to 0·00015. On recasting the residue and the distillate the difference is maintained.

The separation indicated by these figures would imply a change in atomic weight of about $3\frac{1}{2}$ units in the second place in the atomic weight. This is considerably less than might have been expected if the metal was composed of equal quantities of an isotope of an atomic weight of 64 on one hand, and of isotopes 66, 68, and 70 on the other hand.

ALFRED C. EGERTON.
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November 21.

A Curious Feature in the Hardness of Metals.

BY combining Meyer's formula

$$L = ad^n$$

with that for the ordinary Brinell test

$$H = L \div \frac{\pi D}{2}(D - \sqrt{D^2 - d^2})$$

the following relationship is obtained:

$$H = \frac{2}{\pi D} \cdot a^{\frac{2}{n}} \cdot L^{\left(1-\frac{2}{n}\right)} \left\{ D + \sqrt{D^2 - \left(\frac{L}{a}\right)^{\frac{2}{n}}} \right\}.$$

In this the second term ceases to have a real meaning when

$$D = \left(\frac{L}{a}\right)^{\frac{1}{n}}.$$

Beyond the load corresponding to a value

$$L = aD^n$$

the hardness becomes imaginary, or, in other words, the load will be sufficient to force the ball through the material continuously. This fact may well be of considerable importance in connexion with such questions as the penetration of a plate by a projectile, in punching operations, and even in lathe work.

In the case of a steel of 0·2 per cent. carbon and 0·6 per cent. manganese with a Brinell hardness number of 140, using a ball of 10 mm. diameter, and a load of 3000 kilograms, the values of a and n will be about 74 and 2·29 respectively. Under these conditions the load at which perforation of the steel will occur will be 14,400 kilograms, when the hardness will have fallen to 92.

Further work in this direction is being carried out by one of us; but the fact that there is a high load at which the ordinary hardness measurements cease to apply, and the possible significance of the fact, seemed sufficiently interesting to warrant early publication.

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November 15.