in the average rate of loss of heat by convection, and consequently there is a fall in the temperature, and hence in the resistance, of the grid. The fall in resistance can be measured by a Wheatstone bridge method. The way in which it is suggested that this process may be utilised in the construction of a standard source of sound is as follows. The source is made in the form of a cylindrical Helmholtz resonator—say from brass tubing about 2 in. diameter. At one end is fitted a telephone in such a way that the diaphragm forms part of the inner wall of the resonator, while at the other end is the orifice carrying the hot-wire grid. If the telephone diaphragm is made to vibrate by current from a thermionic valve oscillator, and the frequency of the current is adjusted until it is equal or nearly equal to that of the resonator, a pure tone of moderate intensity issues from the orifice. At the same time the hot-wire grid suffers a change of resistance which provides a measure of the amplitude of the vibration in the orifice, and hence of the *strength* of the source. With a standard pattern grid and holder the change in resistance is about 12 ohms when a sound of pitch 200 vibrations/sec. is produced, which is loud enough to be just audible at a distance of 10 feet—the source being placed on the ground in the open. The strength of the source can be varied at will by using a variable series resistance or a shunt with the telephone. The use of resonance serves to purify the note which comes from the telephone, but it is desirable in addition that the oscillator should be of such a type that the telephone note is already fairly pure. The use of a very impure note may lead to poor results, as the resistance change will then depend only partly on the amplitude of the fundamental.

It may be noted that a simple method is known of obtaining the relation between the change in resistance of a grid and the amplitude and frequency of the vibration producing it—the motion being simple harmonic. Hence, if the frequency of the vibration is known, the strength of the source (defined as the rate at which fluid is introduced or abstracted at the source) can be found in absolute measure. The amplitude of the waves—or, if preferred, the flux of energy—in the surrounding medium can then be calculated in certain cases. A simple case is when the source is close to a rigid plane.

Any other means of producing a suitable sound can be used in place of the telephone diaphragm provided it is small enough to go inside a resonator. If the damping factor of the resonator has been determined experimentally, the acoustical output of the primary source inside the resonator can be calculated from the indications of the hot-wire grid in the orifice. The output of the internal source includes (1) the radiation of acoustical energy from the orifice, which has been dealt with above, and (2) work done against viscous forces in the orifice. Unless the orifice is large, (2) is far the more important part, and the radiation losses may be negligible by comparison.

E. T. PARIS.

Signals Experimental Establishment,
Woolwich, S.E.18, Sept. 2.

Occurrence of the Rare Whale, *Mesoplodon Layardi*, on the Tasmanian Coast.

SOME years ago, on July 30, 1918, my friend Mr. G. H. Smith of Leprena, Southern Tasmania, brought me word that a beaked whale, "without teeth," had been cast up on the beach at Recherche Bay near his property, that he had already removed the blubber, and that the carcase still remained on the shore. Being occupied at the time with university teaching I was unable to visit Recherche Bay till some weeks later. High seas were then running, and the remains had been lifted by these and thrown farther up on the basaltic boulders which strew the beach at this spot. This resulted in some considerable damage to the skeleton. Nearly all the ribs were broken, some into three or four pieces, and many of the neural spines had been smashed from the vertebrae. The skull was also damaged, although some of the flesh and integument was still adhering.

The body was naturally in a somewhat decayed and pulpy condition, but with Mr. Smith's help I was able to salve the remains and so obtain the skeleton. This is almost complete and is now in my Department.

My friend was good enough to hand me some measurements and notes which he had made and these I reproduce. The animal "was a female whale. The total length was about 18 ft.; its jaws were 2 ft. 6 in. long, about 4 in. in diameter at the end, no teeth above the gums. Fins 2 ft. long, 8 in. wide, and tapered, not round like the black whale type. Its flukes were about 4 ft. wide; it had the appearance of a fast fish as it was rather thin in the body. There was a small fin on its hump, about a foot high, with a decided rake towards the tail. The colour the same as the sperm whale, dark grey and light underneath." Mr. Smith further states that the blubber yielded 50 gallons of oil of the finest quality, and that he believes that the animal was driven ashore by "killers," of which there were a number in the bay at the time. There were, however, no marks of injury on the body.

The matter of recording this specimen seems called for, particularly in view of the description by Mr. E. R. Waite, director of the South Australian Museum (Rec. S. Aus. Mus., vol. ii., No. 2), of the discovery, on the South Australian coast, of an immature male of this species of Mesoplodon. The Tasmanian specimen was a female and mature, as is witnessed by the condition of the skeleton and by the fact that the pulp cavity of the tooth is entirely closed below.

The form of the tooth corresponds exactly with that figured by Gray for his *Callidon güntheri* (Ann. Mag. Nat. Hist., 1871), which, as Flower and Turner suggested, was a female of the present species. It seems now that we must conclude from Waite's description that the mature condition of the tooth in the female represents a stage which is early passed through in the male.

No pelvic bones were discovered, nor was there any trace of the denticles found in the integument of the jaws of other species. The oil has a density of 0·88 at 12·5° C. This whale has now been recorded from the coast of every Australian State except Victoria and West Australia.

T. THOMSON FLYNN.

University of Tasmania, Hobart, July 20.

Atoms and Electrons.

ON the basis of any theory of atomic structure which classifies the elements according to rare gas type, cerium and thorium should be comparable with one another, since the atoms of each are possessed of four electrons more than those of the corresponding inert gases, xenon and niton respectively. There are, however, in the thorium atom, thirty-two more extra-nuclear electrons than in the cerium atom. In spite of this fact, it appears that *the distances between atomic centres in crystals of these elements are practically the same* (Ce = 3·62 A.U. and Th = 3·56 A.U., according to Hull), the distance being, if anything, slightly the smaller for thorium. Both crystallise in the face centred cubic lattice. If the interatomic distances may be taken as representing atomic diameters, this means that in the same (or slightly less) volume there are concentrated in the thorium atom thirty-two more electrons than in the cerium atom, the total numbers in the two cases being, respectively, ninety and fifty-eight.

Thorium is the next to the last element in the periodic table possessed of particular stability. Between the last, uranium, and neodymium in the preceding period, a structural relationship exists similar to that between thorium and cerium. The crystal structures of these elements by the X-ray method have, unfortunately, not been worked out. However, an approximate idea of the relative sizes of the atoms of these substances may be gained by a comparison of their atomic volumes. According to Landolt-Börnstein's "Tabellen," the densities of neodymium and uranium are 6·96 and 18·7 respectively. Dividing the atomic weights (144·3 and 238·5 respectively) by these numbers gives for the atomic volume of neodymium 20·7, and for that of uranium 12·8. The corresponding quantities for cerium and thorium are about 20·5 each. It thus appears that *in the atoms of uranium there are concentrated in about one-half the volume thirty-two more electrons than in the atoms of neodymium*, the total numbers of electrons being, respectively, ninety-two and sixty.

It is perhaps significant in view of these facts that elements of higher atomic number than uranium are not known to exist, and that most of those of immediately lower atomic number are unstable. With increasing nuclear charge the attractive forces exerted by the nucleus on the surrounding electrons concentrate the latter nearer and nearer toward the centre of the atom. It does not appear improbable that the exceedingly powerful forces, both of attraction and repulsion, which must result from this concentration may be of sufficient magnitude to assist materially in bringing about those conditions of instability which result in radio-active disintegration. If the large numbers of electrons in the atoms of the radio-active elements be conceived as rotating about the nucleus within the small space which the relatively small atomic volumes allot to the atoms of these elements, with orbits of different periods, there will evidently come times periodically when numbers of electrons in excess of the average will all be exerting attractive forces on the positive nucleus in the same direction. In such circumstances it is conceivable that a positively charged constituent of the nucleus might be drawn out of its normal equilibrium position and, the local attractive forces which held it in its equilibrium position being overbalanced by the repulsive force between this new entity and the positive nucleus acting as a whole, be sent on its path as an α-particle. The rate of decay of the atoms of the elements would then depend on the frequency with which this favourable configuration of electrons, which is just sufficient to exert the critical attractive force, occurred. The more stable the nucleus, the greater would the numbers of electrons all acting in the same direction need to be. But the greater the concentration required, the less frequently will it occur, other things being equal. Hence, for a more stable nucleus the rate of decay must be less. The rate of decay would thus depend primarily on the stability of the nucleus, and the mechanism suggested would constitute the trigger action by which the actual disintegration was brought about.

ROBERT N. PEASE.
(National Research Fellow in Chemistry).
Laboratory of Physical Chemistry,
Princeton University, Princeton, N.J.,
August 6.

The Freshwater Winkle.

I WAS, recently, fortunate enough to obtain a pair of the yellow-bodied variety of the freshwater winkle (*P. contecta*) from what I understand was the first consignment to be imported into this country. Unfortunately the female died, and when I removed it from the aquarium the body fell out of the shell, the snail having apparently been dead a day or two. I then noticed that there was a row of five fully-formed baby snails—about ¼ inch in diameter—in the gelatinous egg-sac.

Although I thought there was little possibility of their being alive, I released them with a pair of scissors and placed them in a saucer of water. For twenty-four hours or so there was no sign of life, but, on the second day, I noticed that an operculum was forming on each and that the tentacled head of two of them had been extruded. These were immediately placed in a well-established aquarium, and the following day the other three were similarly dealt with, they having also become active. All are now feeding upon the confervæ on the sides of the tank and apparently doing well.

I have never heard of such an experiment having met with success, and shall be glad to learn whether the result is new.

A. E. HODGE.

The Effect of a Lead Salt on Lepidopterous Larvæ.

FOR some time we have been studying the effect of adding various metallic salts to the food of the larvæ of Lepidoptera, and, as the results will not be ready for publication for about a year, desire to direct attention to the surprising result of using a salt of lead. When a dozen larvæ of *S. ocellatus* were fed on sprigs of apple which had been treated with lead nitrate it was soon obvious that they were eating more freely and growing more rapidly than the controls; by the time they were about three-fourths grown they consumed double the daily ration eaten by the latter. There was considerable disease among the controls and in another experimental batch, but those getting lead remained perfectly healthy and pupated about a fortnight earlier than the controls. The pupæ were a very fine lot, the males weighing on the average about 15 per cent. more than the controls, and the moths were large and somewhat peculiarly coloured; there were too few females for a comparison to be made. Confirmatory results have been obtained with the larvæ of other moths.

This curious result is not without parallel. The herbage near the chimneys of lead-smelting works contains appreciable amounts of lead, and cases of lead poisoning have occurred among sheep; in Weardale, however, it is a common practice to pasture sheep as near as possible to these chimneys when they are being fattened, as the farmers consider that they fatten much more quickly than on other parts of the moors.

F. C. GARRETT.
HILDA GARRETT.

The Pigeon Tick.

THERE is a slight error in the statement of L. H. Matthews and A. D. Hobson in NATURE of September 2, p. 313, with regard to the latest previous record of the pigeon tick *Argas reflexus*. In 1917 I secured four specimens from the tower of Canterbury Cathedral. At least two living specimens were forwarded to Mr. C. Warburton at the time.

The Cathedral receives a special cleaning every four years and *Argas reflexus* is invariably dislodged on these occasions.

A. G. LOWNDES.
Marlborough College, September 4.