face fauna during the second week of June, and medusæ of *Eucope* were found at various times during the summer. On July 28 an undetermined species of Hydromedusa was so abundant at Menimsha that a tumbler simply dipped into the ocean would be more than half filled with them.

Dr. Murbach has found *Corynitis* breeding during July and the early part of August, *Podocoryne* and *Hypolytus* during August.

Ctenophores, frequent during the early part of summer, literally swarm during the latter part of August. *Mneniopsis* is the most abundant species.

H. C. Bumpus.

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*AN AMPERE BALANCE.**

The Report of the Committee on Electrical Standards for 1897 ended with the following paragraph: "It thus appears to be a matter of urgent importance that a redetermination of the electro-chemical equivalent of silver should be made and that the general question of the absolute measurement of electric currents should be investigated * * *" This work we were asked by the Committee to carry out, and a grant of £75 was voted in its aid. We were thus led to examine into the methods which had been employed by Lord Rayleigh, Professor Mascart and others, for determining the absolute value of a current, as well as to consider some other methods which have not, as far as we know, been hitherto used.

After much consideration we decided to adopt a form of apparatus which, while generally resembling the type employed by some previous experimenters, possessed certain important differences; and, before expending any part of the grant of £75, to construct, without expense to the British Association, the following preliminary Ampere Balance.

On a vertical cylinder about 17 inches high and 6.8 inches in diameter we wound two coils, about 5 inches in height, separated by an axial distance of 5 inches. The coils consisted each of a *single* layer of about 170 convolutions of wire and were wound in opposite directions. From the beam of a balance there was suspended, inside this cylinder, a light bobbin about 4 inches in diameter, on which was wound a coil about 10 inches long, consisting of a *single* layer of 360 convolutions, and the whole apparatus was so adjusted that when the beam of the balance was horizontal the inner and outer coils were coaxial and the top and bottom of the inner suspended coil were respectively in the mean planes of the outer stationary coils.

This arrangement was adopted because with coils consisting of only one layer the geometrical dimensions could be accurately determined, and because the shapes of the coils lent themselves to the use of the convenient formula, readily expressible in elliptic integrals, for the force, F, between a uniform cylindrical current sheet and a coaxial helix, viz:

$$F = \gamma\gamma_h(M_1 - M_2),$$

where γ is the current per unit length of the current sheet, γ_h the current in the helix, and M_1 and M_2 the coefficients of mutual induction of the helix and the circular ends of the current sheet.*

The value of a particular current of about 0.63 ampere having been determined *absolutely* by means of this apparatus, the rate at which it would deposit silver under specified conditions was ascertained indirectly, by observing its silver value on a Kelvin balance which had been kept screwed down in a fixed position for several years past and which had been calibrated many times

* Read before the British Association.

* Proceedings of the Royal Society, Vol. 63, "On the Calculation of the Coefficient of Mutual Induction of a Circle and a Coaxial Helix, and of the Electromagnetic Force between a Helical Current and a Uniform Coaxial Circular Cylindrical Current Sheet," by Professor J. V. Jones.

during that period by reference to the silver voltameter.

The result of this preliminary investigation showed that the silver value of the *true* ampere was so nearly equal to the reputed value, viz., 1.118 milligram per second, as to require the use of an apparatus still more perfectly constructed, and, therefore, of a much more expensive character to enable the error, if any, in this value to be ascertained with accuracy.

We, therefore, started on the design of the instrument, of which we now submit the working drawings, and for the future construction of which we would ask for a grant of £300, including the unexpended grant of £75 voted last year.* And we anticipate that this new piece of apparatus may prove worthy of constituting a national Ampere Balance, the counterpoise weight for which will be determined purely by calculation based on the dimensions of the instrument, the number of convolutions of wire in the three coils, and the value of the acceleration of gravity at the place where the instrument may be permanently set up. In this particular it will differ entirely from the 'Board of Trade Ampere Standard Verified 1794,' which has had its counterpoise weight adjusted so that the beam is horizontal when a current passes through the instrument, which will deposit *exactly* 1.118 milligram of silver per second under specified conditions. In fact, the proposed Ampere Balance and the existing Ampere Standard will differ exactly in the same way as do a Lorenz apparatus and the 'Board of Trade Ohm Standard Verified, 1894.'

We have to express our thanks to Mr. Mather for taking charge of the construction and use of the preliminary apparatus, for checking all the calculations in connection with the determination of the electro-chemical equivalent of silver that was made with it, as well as for superintending the making of the working drawings of the new Ampere Balance.

We have also to thank Messrs. W. H. Derriman and W. N. Wilson, two of the students of the City and Guilds Central Technical College for their cordial assistance in carrying out the work.

W. E. AYRTON,
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* This grant of £300 has since been made.

NOTES ON PHYSICS.

ELECTRICAL VIBRATIONS.

IN *Wied. Ann.*, 1898, No. 11, M. Abraham gives a solution for the electrical oscillation of an ellipsoidal conductor (ellipsoid of revolution) and an approximate solution for the electrical oscillation of a straight rod. Perhaps the most interesting feature of the paper is the detailed analysis of the reflection of an electrical wire-wave from the free end of the wire.

The wave-length of the Hertz waves sent out from a vibrating rod are shown to be the double length of the rod, a fact which has been known experimentally for some time, and the overtones are harmonic.

It may be remembered that Tesla, a few years ago, suggested (and perhaps tried!) the use of electrical oscillations of the earth as a means of telegraphy. The solution of the problem of the electrical oscillation of a sphere was well known (?) at the time, and this solution indicates that to maintain the electrical oscillations of a sphere only a few inches in diameter would require *millions of horse-power*, and, of course, to stir up the earth electrically would require an enormously greater amount. Tesla did not succeed.

MANOMETRIC FLAMES.

PROFESSORS NICHOLS and Merritt publish, in the August number of the *Physical Review*, an interesting series of manometric-flame photographs. The reproductions are as good, perhaps, as is possible, but the original