

of some of the tunnel-weavers belonging to the family *Drassida*, which merely construct a web to serve as a nest during the breeding season.

But to strengthen the probability that such an evolution of webs has ever occurred, it is necessary to be able to show in what respects a snare composed of radiating and concentric lines may excel in efficacy the sheet-like web of a *Tegenaria* or the tangled mass of threads of a *Phalcus*.

Firstly, it seems clear that threads which radiate directly from the spot where the spider is stationed, must more rapidly and more certainly inform her of the position of a struggling insect than irregularly crossing threads, which must spread the vibration indiscriminately in all directions; and the advantage of there being as little delay as possible on the spider's part, between her perception of the vibration and her arrival at the spot, where it originates, will be readily understood by those who have observed powerful insects break loose from the web before being seized by the spider. Secondly, the object of the concentric lines is evidently to support the radii and to fill up the spaces between them. It may perhaps be urged, however, that these two ends would be apparently more satisfactorily attained if the inter-radial areas were filled in by a complete sheeting of web, or, at all events, by a larger number of threads than is used by an *Epeira* for this purpose. But it must be remembered, in the first place, that in proportion as the mesh of the web becomes closer, the whole structure is rendered more and more liable to be beaten down by the rain, or blown into shreds by the wind, unless its supports are correspondingly multiplied; and in the second place, that every thread of white silk that is added to the web, tends to make it more and more conspicuous, and so to convert it into a visible object, which will serve as a warning to wary flies, and as an attraction to marauding wasps. And these are the two ends which it is particularly the spider's interest to avoid, inasmuch as they are alike detrimental to its chances of life.

It is legitimate, therefore, to conclude that the principal, if not the sole factor that has guided the evolution of the orb-web, has been the advantage gained by a delicacy of construction, involving comparative invisibility. But the making for invisibility has been kept in check, and has not been permitted to go to the length of interfering with the efficacy of the web as a net, for which a closeness of mesh and strength of thread sufficient to intercept and hold insects is a vital necessity for the spider.

Seeing, then, the advantage of the radiating threads as rapid and sure transmitters of vibration, and the necessity for a net as inconspicuous and delicate, and yet as strong as possible, we are led to inquire if the method of filling up the inter-radial spaces with concentric lines is not calculated to afford the greatest possible support to the radii. This inquiry must, I think, be answered in the affirmative. For if, as is the case here, the threads be drawn from points on one radius to points on another, so as to make the two interior angles on either side of them equal, these threads are the shortest that can be made; and the shorter the threads, the less their elasticity, and the greater the support they supply to the radii. This fact alone has been, one would think, of sufficient importance to bring about the concentric arrangement of the supporting lines. But more than all this, it is also to be borne in mind that the shortest threads utilise the smallest quantity of silk, and take the shortest time to spin. So that, in constructing a net of radiating and concentric threads, it appears to me that an *Epeira* economises both time and silk, and in addition renders her snare as strong and as serviceable, and yet as delicate and invisible, as possible.

R. I. POCKOCK.

NEW METRIC STANDARDS.

THE President of the Royal Society, with Sir John Evans, and the following members of the Council—Dr. A. A. Common, Mr. W. Crookes, Dr. A. R. Forsyth, Prof. H. Lamb, Prof. J. H. Poynting—visited the Standards Department of the Board of Trade on Thursday, the 21st inst., for the purpose of inspecting the new metric standards which have been recently deposited with the Department. The President and Council were received by Sir Courtenay Boyle, K.C.B., the Secretary of the Board of Trade, and Mr. H. J. Chaney, Superintendent.

Two new metric standards, of length and mass respectively (*des prototypes nationaux*), were delivered to the Board of Trade by the International Committee of Weights and Measures at Paris on September 28, 1889, and the third and final standard was received from the Committee in December last. All three standards are deposited at the Standards Office, 7, Old Palace Yard, Westminster, and are available for use in the verification of metric standards for the purposes of science.

The two standards received in 1889 include a "line" standard metre measure (*mètre à traits*) and a kilogramme weight. The standard received last year is an "end" standard metre (*mètre à bouts*). These three standards, together with other similar standards supplied to twenty-one different States, are, *inter alia*, the outcome of the results of the labours of the International Committee for more than twenty years; and Great Britain is the first country which has received all three of such standards.

The standards were verified at the Bureau International des Poids et Mesure (*Pavillon de Breteuil, Sèvres, près Paris*), which bureau was established under a Metric Convention, dated May 20, 1875, signed by twenty different High Contracting States, exclusive of Great Britain, who finally joined the Convention in September 1884. The Committee is a self-elected body, and is founded and maintained by common contribution from all countries who are parties to the Convention of 1875. The bureau of the Committee is required to be near Paris, and has been declared to be internationally neuter. The Committee was charged in 1875 with the construction, restoration, and verification of new metric standards (*des prototypes internationaux*) to replace the ancient standards of France (*mètre et kilogramme des archives*), and with the verification of copies of the new standards for all the contracting States. By such means the international accuracy of metric standards is now assured throughout the world.

The Committee, which includes thirteen members, undertakes also the verification of standards for scientific authorities or persons.

The Mètre.

The two metric standards above referred to are made of iridio-platinum, or an alloy of 90 per cent. of platinum and 10 per cent. of iridium. The metres are in transverse sections, nearly of the form of the letter X, known as the Tresca form, and selected as being not merely as the most economical (iridio-platinum being a costly metal), but as being less affected by heat, practically non-oxidisable, and well adapted for receiving finely engraved lines. This alloy appears to be of all substances the least likely to be affected by time or circumstance, and has been preferred for standards purposes to rock-crystal, gold, &c. The lines on the *mètre à traits* are fine, and are barely visible to the naked eye.

The actual relation of our prototype metre No. 16 is as follows:—

At 0° C.

$$\text{No. 16} = 1 \text{ metre} - 0.6 \mu \pm 0.1 \mu \text{ at } 0^\circ \text{ C.}$$

Here μ means one micron, or one-thousandth of a millimetre (or nearly 0.00004 inch), so that metre 16 may

be said to have been verified with an accuracy of one part in a million.

The certificate of the verification of the end standard, or *mètre-à-bout* (étalon No. 6), will not be issued by the Committee until their general conference in September next; but this standard has been verified also with great accuracy, with a probable error of $\pm 0.3\mu$. In the verification of the end standard (*mètre-à-bout*) MM. Cornu and Benoit have introduced a method of reflection, by means of which it is unnecessary to bring the ends of the metre bar into contact with any touching surfaces, and thus the measuring ends of the bar may be carefully preserved and used. Only Austro-Hungary, Germany, Great Britain, and Russia have at present applied to the International Committee to be supplied with end standard metres.

Experiments with reference to light-wave analysis, which have been carried out under the directions of the International Committee by Dr. Michelson during 1893, with the view to the discovery of a radiation of light of sufficient homogeneity to serve as an ultimate standard of length, appear to show that it is possible within certain limits to reproduce the length of the metre by reference to such physical constant.

The Kilogramme.

The unit of mass of the kilogramme is determined by a piece of iridio-platinum in the form of a cylinder, the height and diameter of which are equal (thirty-nine millimetres). The kilogramme, No. 18, supplied to Great Britain has no distinguishing marks, and is highly polished. On analysis it showed very faint traces of ruthenium, rhodium, and iron. Its volume was found to be at 0°C .

Prototype 18 = 46.414 millilitres,
corresponding to a density of—

21.5454 .

After its final adjustment it was found to be *in vacuo* at 0°C .

Prototype 18 = $1\text{ kg.} + 0.070 \pm 0.002$ milligramme.

So that it may be said that the kilogramme (kg.) has been verified with a probable accuracy of 0.002 parts in a million.

NOTES.

THE Committee of the Athenæum Club, acting under the Rule which provides for the annual election of persons "of distinguished eminence in science, literature, the arts, or for public services," have admitted to membership Prof. Bayley Balfour, F.R.S., and Sir W. H. White, K.C.B., F.R.S.

DR. F. J. LAUTH, the eminent Egyptologist, died at Munich on the 11th inst., at the age of seventy-three. He was Honorary Professor of Egyptology at the University of Munich, and Keeper of the Egyptian Collections. His writings on the antiquities of Egypt are numerous and important.

WE regret to announce the death of Prof. Heinrich Wild, of St. Petersburg. He was a Swiss by birth, and his work in magnetism and optics, as well as the magnetometer, polaristrometer, and other instruments devised by him, are well known to students of physics.

It is reported from Athens that the architect who has examined a number of the ancient monuments in Athens, states that the majority of them, and particularly the Parthenon and the Temple of Theseus, are in a dangerous state. The work of rendering them secure would cost a million drachmas. The Archæological Society intends to make an appeal to all countries for a portion of the money required to restore these wonderful monuments to a sound condition.

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GENERAL ANNENKOFF, constructor of the Russian Central Asian Railway, has been appointed one of the vice-presidents of the International Congress of Geography to be held in London in July next. Russia will further be represented on that occasion by nine or ten other well-known men, including Senator Semenov (vice-president of the Imperial Russian Geographical Society), M. Grigorieff (secretary of the same society), and Baron Wrangel (director of the Imperial Lyceum).

A REUTER telegram from St. Petersburg reports that a scientific expedition, organised by the French Minister of Public Works, has just arrived at Samarcand. The head of the expedition is M. Jean Chaffanjon, who has previously made a journey in South America, and he is accompanied by two naturalists, MM. Henri Mangin and Louis Gay. From Samarcand the expedition will proceed to Tashkend, and after completing all the necessary preparations there, will start on a journey of exploration in Tibet and other countries.

WE are informed by the trustees of the Australian Museum, Sydney, that Dr. E. P. Ramsay, after twenty years' service as Curator of this Museum, has retired, owing to ill-health. Dr. Ramsay's official connection with the Museum as Curator ceased from December 31, 1894. The trustees have appointed as his successor Mr. R. Etheridge, jun., formerly of the British Museum, and lately Palæontologist to this Museum, and to the Department of Mines of New South Wales, and who has on several occasions temporarily acted as Curator. Mr. Etheridge has entered on the duties of Curator.

DR. A. R. WILLIS will commence a course of six lectures to working men at the Museum of Practical Geology, Jermyn Street, on Monday, March 4. The subject of the course is "Heat Engines."

THE weather over these islands has been comparatively mild during the past week, and the higher temperatures which set in at the end of the prolonged frost were maintained for some days; subsequently there was a slight return of cold, with high barometric pressure, accompanied by strong north-easterly winds, and snow showers in various places. Frost occurred on Sunday and following nights, the lowest shade temperatures being 22° in the central parts of Ireland, while in the south-eastern and midland portions of England the readings were several degrees below the freezing point.

AT a recent meeting of the Vienna Academy of Sciences, the President announced that the late Herr Joseph Treith, director of the First Austrian Savings Bank, had bequeathed the whole of his considerable fortune to the Academy for the purpose of the advancement of science. The grants are to be apportioned by a committee of five, three of whom are to be appointed by the Academy, and two by the Minister of Education, the Academy to decide all doubtful questions. The branches of science to be encouraged are those for which there is no other official provision made. Among the subjects suggested are the physical structure of the earth and of the heavenly bodies. The income is to be divided every year into several grants, but if some great enterprise is to be undertaken, it shall be permitted to let the funds accumulate for not more than three years. The extension of higher instruction among all classes fitted for it by education, the strengthening of moral character, the advancement of technical education, the simplification of medical practice, and the furtherance of the material prosperity of the human race by invention and discovery, are the guiding principles indicated by the donor for the administration of his generous gift.

AT the last meeting of the Société Française de Navigation Aérienne, M. de Fonvielle gave an account of a paper by M. André, the chief engineer of the Swedish Patent Office, read