obtained, and by bringing the iron keeper near to, or even into gentle contact with the magnet, every grade and rate of simple vibration could be reproduced, as the present writer is able to testify.

With this instrument Reis obtained better results and even transmitted imperfect articulation. Legat speaks of single words in reading and speaking being indistinctly heard; but any sudden modulation of the voice as in surprise, interrogation, &c., was clearly reproduced. Still more definite is the following statement, occurring in an article on Reis's improved telephone in No. 15 of Böttger's *Polytechnisches Notizblatt* (1863):—"The experimenters could even communicate to each other words, only such, however, as they had already heard frequently." In confirmation of this the present writer has received a letter from Dr. Messel, a name well known to chemists, who was a former pupil of Philip Reis and an eye-witness of his early experiments. Dr. Messel states—"There is not the shadow of a doubt about Reis having achieved imperfect articulation; I personally recollect this very distinctly and could find you many others who were witnesses of the same fact."[1]

As an interesting sequel to this historical note it should be mentioned that in 1865 Mr. S. Yeates, the skilful instrument maker of Dublin, introduced some modifications in one of Reis's instruments he had purchased, of the usual early form, which enabled him to obtain the distinct articulation of several words. The modifications were twofold: (1) the knitting needle receiver was replaced by an electro-magnet and movable keeper, as Reis had already done, though unknown to Mr. Yeates (see Fig. 5); and (2) a drop of very slightly acidulated water

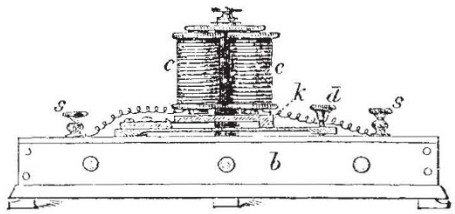

FIG. 5.—Yeates's receiver for Reis's telephone. Upon the sounding box *b* an electro-magnet *cc* is supported by the brass pillar seen behind. A light iron keeper *k* is fastened at one end by a steel spring to a wooden bridge, which can be raised or lowered by the screw *d*, so that the keeper can be brought almost into contact with the electro-magnet. The circuit is completed by the binding screws *s s*.

was placed between the contact pin and the metal disc on the membrane. The intermittent character of the current was thus abolished, and a very near approach made to the true principle of an articulating telephone, namely, the employment of a *continuous current* of varying strength. This instrument was shown in November, 1865, at a meeting of the Dublin Philosophical Society, and some members of that society who were then present have testified to their remembrance of the fact that several words were transmitted fairly well. It is to be regretted that at the time Mr. Yeates did not pursue the matter further, nor give a wider publication to the success he obtained.

But between the best of the results obtained by Reis and others in the direction of articulation, and the splendid achievements of Prof. Graham Bell, there is unquestionably a very wide step. In the sensitive and beautiful instrument discovered by Prof. Bell, the voice of the speaker generates thrills of magneto-electricity, which, being strictly proportional to the sonorous vibrations, reproduces the voice and its expression in the receiver in a fairy-like far-away whisper. Nevertheless it must be borne in mind that it is unlikely the telephone of the future will employ the voice to generate the driving power, but only to modulate the flow of a current obtained by coarser means. It is in this direction that Reis worked, and though his method was faulty in the employment of an intermittent current, the same cannot be said of the arrangements adopted by Mr. Edison, of New Jersey. And inasmuch as Mr. Edison has already discovered and brought to a practical issue such remarkable additions to our knowledge as quadruplex telegraphy, the electro-motograph, and the phonograph, we have, in these achievements, the earnest of success to those excellent telephonic investigations wherein Mr. Edison has already won an enduring fame.

W. F. BARRETT

P.S.—Since writing the foregoing article, the publication of which has been for some time delayed owing to the crowded state of the columns of NATURE, my attention has been drawn to a claim made by Mr. John Cammack, to be the first inventor of the electric telephone. From this it would appear that in the early part of 1860 Mr. Cammack made and exhibited an electric telephone, whilst a student in the Royal School of Medicine, Manchester. A photographic copy of the original drawing of the instrument has reached me, and so far as this goes it embraces not only the intermittent current used by Reis, but the principle of the continuous current of varying strength employed by Bell and Edison. In fact, if Mr. Cammack can furnish historical proof, the arrangement shown in his drawing, with its explanatory note, is identically the same as the method, long after independently invented and patented by Prof. Graham Bell.[1]

W. F. B.

ACTION OF LIGHT ON A SELENIUM (GALVANIC) ELEMENT

IN the course of a series of experiments on the electrical behaviour of selenium, undertaken with a view to remove, if possible, the difficulties in the way of constructing constant resistances of this material, I have had occasion recently to investigate the effects of surface tension due to light.

I find that the action of light on crystalline selenium (annealed at 200° C.) is much more striking when the selenium forms one element of a galvanic couple than when it acts as a resistance.

The most convenient arrangement which I have found for observing this, is to make up a couple consisting of (1) a plate of selenium hanging suspended by means of a platinum wire, and (2) a strip of platinum foil, in distilled water. The potentials of the two poles are not very different, and any change in the electro-positiveness of the selenium is at once very apparent.

The first selenium-platinum element which I constructed behaved as follows:—

In the dark the element gave a steady electromotive force of about 0·1 volt, the selenium being *positive* to the platinum. On admitting daylight to the selenium plate it instantly became *electro-negative* to the platinum, showing an electromotive force of 0·05 volt in that direction. That is to say the selenium had become 0·15 volt more electro-negative by the action of the light than it was in the dark.

[1] My best thanks are due to Dr. Messel for much information concerning Reis and for a reference to his papers in the journals alluded to.

[1] Perhaps the word "claim" is too strong, as I observe Mr. Cammack speaks very modestly of the idea he so early sketched out. Such ideas are of course valueless in a practical sense, unless brought to the test of experiment, and this Mr. Cammack seems only partly to have done; this too is just where Prof. Bell succeeded; by his persistent experiments overcoming all obstacles and affording by the way a striking illustration that facts may after all upset the strongest *à priori* conclusions. In connection with this remark the following passage from the last edition of a well-known work on Mental Physiology (p. 632), is not without interest:—"Everyone who accepts as facts, merely on the evidence of his senses, or on the testimony of others who partake of his own beliefs, what Common Sense [with capitals] tells him to be much more probably the fiction of his own imagination—even though confirmed by the testimony of hundreds affected with the same epidemic delusion—must be regarded as the subject of a 'diluted insanity.'" Yet Baron Münchausen's trumpet has been outdone by the phonograph: the "fiction of imagination" by a fact "confirmed by the testimony of hundreds." However as these latter have "merely the evidence of their senses to offer," we presume they are all the victims of "a diluted insanity," if the reasoning of the eminent author be accepted.

After the first impulse this extreme electro-negativeness of the selenium, due partly to polarisation, gave way and it gradually passed again to the electro-positive side, where, after a few minutes, it settled to a constant value, but still electro-negative to its condition in the dark.

I found that the slightest shadow or other variation in the intensity of the light caused a considerable variation in the electromotive force of the couple and a consequent indication.

On excluding the light the selenium instantly increased in electro-positiveness, and soon settled to its original position.

A couple in which two plates of selenium were opposed to each other, light being excluded from one and admitted to the other, gave identical results, only the resistance of the element was much greater.

The effect of light, therefore, in modifying the surface tension of selenium is evidently to render it more electro-negative and presumably not more metallic, as has been suggested in explanation of its increased conductivity.

I am endeavouring to construct a combination of selenium elements which, with a mirror galvanometer and photographic arrangement may be used to give a trustworthy record of the intensity of daylight. The practical difficulties in the way at present I have hopes will not be insurmountable. ROBERT SABINE

NOTES

WE regret to notice the death, on the 18th inst., of Dr. Thomas Thomson, F.R.S., for some years Superintendent of the Botanic Gardens at Calcutta, and joint author of Hooker and Thomson's "Flora Indica." He was also a contributor to Sir J. D. Hooker's "Flora of British India," now in progress.

THE following are the names of those whom the Council of the Royal Society have recommended for election on June 6 next as appointed:—J. G. Baker, F. M. Balfour, Rev. T. G. Bonney, Prof. J. H. Cotterill, Sir W. Elliot, Canon W. Greenwell, T. Hawksley, C.E., J. Hopkinson, D.Sc., J. Hughlings Jackson, M.D., Lord Lindsay, P.R.A.S., S. Roberts, E. A. Schäfer, H. Sprengel, G. J. Symons, and C. S. Tomes.

THE scientific world has sustained a loss by the decease of the Rev. James Booth, LL.D., F.R.S., Vicar of Stone, near Aylesbury, which occurred on the 15th inst., at the age of seventy-one. He was educated at Trinity College, Dublin, where he obtained several prizes and graduated in honours. He was elected a Fellow of the Royal Society in 1846, to a very great extent in recognition of his earliest publication, "A New Method of Tangential Co-ordinates," and also as the inventor of a new system of parabolic trigonometry. In 1852 and 1853 he contributed to the *Philosophical Transactions* two memoirs on "The Geometrical Properties of Elliptic Integrals." He was also known as the contributor of several papers on mathematical subjects to the *Philosophical Magazine*, and not a few of these, we believe, have found their way into other languages. In 1859 he was presented to the living of Stone by the Royal Astronomical Society, to whom the advowson belongs.

DR. FREDERICK KAMPF, who has been the astronomer of Lieut. Wheeler's U.S. exploring expedition, died in Washington, on March 30, at the age of thirty-six. Dr. Kampf was educated at Bonn, and emigrated to the United States in 1870, securing a position in connection with the United States Coast Survey until 1873, when he joined the party of Lieut. Wheeler as already mentioned. He promised to attain to much distinction as an astronomer and observer, and his untimely death is much to be lamented.

THE collection of shells of the late Dr. P. P. Carpenter, of Montreal, is for sale. The opportunities of Dr. Carpenter for making this collection of desirable specimens were very great, especially from the great Reigan collection of Mazatlan shells, which he purchased many years ago, and after investigation deposited duplicate series in several museums in Europe and America. The collection embraces about 4,000 species and varieties, for the most part original types. The collection is deposited for the present in the museum of M'Gill College, Montreal.

DR. RUD. FALB, of Vienna, who is engaged in studying the earthquake region in South and Central America, has left Chile and announces his arrival at Arequipa. He intends to ascend the volcano of Misti, near Arequipa, which is some 17,600 feet in height. He also reports that at the southern part of the Peruvian coast the shocks of earthquake continue with unabated violence, and that a violent eruption occurred recently from the Cotopaxi Volcano in the Andes of Quito, without, however, doing much damage.

AN Ethnographical Congress will assemble in Paris on June 24, and continue for three days. The head-quarters of the Commission are rue Monsieur, 19.

The Chair of Surgery at the Collége de France, occupied by the late Claude Bernard, has been offered to Prof. Charrot. It has been decided to erect the statue of the distinguished physiologist immediately before the Collége de France.

DR. E. BAUMANN, one of the most promising of the young physiological chemists of Germany, has received a Professorship in the Berlin University.

WE notice the death of Prof. H. Girard at Halle, on April 12. He was, until a recent date, director of the Mineralogical Museum of the University of Halle, and his name is associated with several mineralogical researches, more especially in connection with the Stassfurt deposits.

AMATEURS of spectrum analysis will thank Mr. Browning for a little pocket case he is now selling which permits a study of absorption phenomena in a very satisfactory manner. Various substances, which give very characteristic band absorption, have been mixed with gelatine so as to form a thin transparent coloured film. In that we have received, roseine, eosine, cochineal, indigo, aniline blue, Hofmann's violet, and other colouring matters have been treated in this way. There are twelve differently coloured films in all, and the variations in the spectra are very striking. On holding the films horizontally close to the slit so that one film falls on the upper and the next on the lower part of it, a capital idea of the use of comparison spectra can be gained.

M. DABRY DE THIERSANT, a French *Chargé d'Affaires*, who has been instrumental in introducing a number of Chinese plants and animals into his native country, is now making arrangements for importation in quantities of the *setz*, one of the most valued fish found in Chinese waters. The fish belongs to the carp family, and when fed on sea-plants in ponds, attains with great rapidity a weight of about forty pounds. During the past three years experiments made on the fish in the Jardin d'Acclimatation have shown it to be well adapted to a European climate, and as it increases rapidly, it is hoped that within a few years it can be introduced extensively throughout Europe.

A LITTLE village in the neighbourhood of Draguignan, France, has lately been the scene of a remarkable subsidence which has attracted the curious from all directions. An elliptical tract of ground, containing over 10,000 square feet, sank gradually one day, accompanied by loud noises, until it left an orifice of over 100 feet in depth, with water at the bottom. Numerous trees and vines disappeared completely in the depths of the new lake. A similar depression on a smaller scale occurred in the same vicinity a century ago, and both the phenomena are attributed to the action of subterranean streams.