THURSDAY, MARCH 30, 1882

ORIGINS OF ENGLISH HISTORY

Origins of English History. By Charles Elton. (London: Quaritch, 1882.)

MR ELTON'S work will at once take the place it deserves. It will be welcomed by the many students who have been long waiting for such a treatise on our country as it was during the ages lying just outside the broad daylight of history. The subject, with all the new resources of archæology and philology which have been brought to bear upon it, still presents a set of problems full of doubt and difficulty; but it will be seen that Mr. Elton's task has been not merely to bring these problems into shape, but to advance them by investigations of his own.

In the introductory chapter, which deals with the knowledge of the ancients as to our part of the world, it is satisfactory to find the author bringing down to their real value the popular stories of Phœnicians in Britain. What is really recorded of the merchant-sailors of Carthage is their commerce with the tin-islands, but these Kassiterides, Œstrymnides, or Hesperides, are set down in Ptolemy's map as being off North-Western Spain, and it was Camden and other moderns who identified them with the Scilly Islands, so bringing the Phœnician galleys up into the British Channel. In 1874, at the Congress of Prehistoric Archæology at Stockholm, Dr. Hildebrand read a paper on the Kassiterides, which Mr. Elton does not seem to have met with, but which tallies closely with his own argument that the ancient accounts of their situation point to the Spanish coast. Dr. Hildebrand supposes the so-called islands to be only the headlands of Galicia, where tin is still mined, while Mr. Elton suggests that they were the little islands about Vigo Bay, an idea which would be strengthened by proof of old tin-workings being found there. Kenrick's argument that the tin-islanders going to sea in boats of leather were ancient Cornishmen paddling across to Scilly in "the characteristic boat of Britain" is fairly met by Mr. Elton, who points out that the Iberians had coracles as well as the Britons. Thus it is to be feared that Cornish history must give up the picturesque scenes of black-cloaked Kelts crossing to St. Michael's Mount at low water to barter their tin for the purple and fine linen of the Phœnician merchants, and to learn from them the art of scalding "Cornish cream." More substantial records of early Britain are to be had from a source long discredited but now restored to credit. This is the famous voyage of Pytheas to Thule, where he saw the midnight sun, and by describing this and other wonders of the north made himself the reputation of an arch liar, till now, two thousand years afterwards, his townsmen the merchants of Marseilles have set up a statue to him as the leader of the first Arctic expedition. In working out the details of Pytheas's expedition, our author follows him up the Spanish and French coast, by the British Channel into the German Ocean, up to Lapland (which he takes to be Thule), and down the east coast of England, back to Bordeaux. He makes Pytheas, after leaving Cadiz, come to the tin-islands, but it is not plain whether there is some actual record of this visit, or whether it is merely inferred that coasting up Spain above Cape St. Vincent must have brought him to the Kassiterides. The explorers passed the mouths of the Loire, and rounding Brittany, landed at Axantos (still Ushant), where they saw the temple and its nine priestesses keeping up the eternal fire. Not knowing how near he had come to the tin-districts of Cornwall, Pytheas sailed up Channel to the coast of Kent. Here he had reached the ordinary crossing-place between Britain and Gaul, and here Mr. Elton places that much debated island which Timæus called Mictis, lying inwards six days' sail from Britain, in which the tin is found, and to which the Britons navigate in their coracles; while Posidonius describes it as an island lying off Britain, called Ictis, to which the miners of Cornwall carry their tin, taking it in carts across the intervening space which is left dry at ebb tide, and there the merchants buy it and convey it across to Gaul, whence it is carried on pack-horses down to the Rhone. Mr. Elton's suggestion is that this Mictis, or Ictis, was the Isle of Thanet, six days' sail from the part of Britain where the tin comes from, and which, though now silted up almost close to the mainland, was even as late as the ninth century separated from it by a ferry half a mile wide. This is a very ingenious attempt to get over the difficulty in the ordinary theories, of putting St. Michael's Mount six days' sail from Britain, or of getting carts across to the Isle of Wight at low water. It has, however, its difficulties to meet, as the above extracts show, and Mr. Elton must be left to fight his own battle with the antiquaries.

Historians' ideas of the early inhabitants of Britain have changed curiously from those of a generation or two ago, when it was undisputed matter of fact that the Kelts were the aborigines of our islands, sprung from *Gomer*, son of Japhet, who colonised Gaul, and left his name to his descendants, the *Cymry*. Nowadays the Kelts have sunk into comparatively modern Aryan invaders, and the question is, How many peoples are to be traced before them? In the present state of the evidence, our author will hardly be found fault with for assuming three earlier races: first, the men of the Palæolithic or Mammoth period, who have not been proved to be connected with later inhabitants; second, the short, dark, narrow-skulled tribes who may be called Silurians, whose long-shaped burial-mounds contain stone weapons of Neolithic type, and whose descendants are to be recognised by their appearance, especially in South Wales and Ireland, though they now speak a Keltic tongue; third, a taller broad-skulled people seemingly of fair hair and complexion, and possibly allied to the modern Finns, who by their remains in the round barrows appear to have come hither armed with weapons of bronze, and encroached on and eventually mixed with their predecessors. After all these came in the invading Kelts, who were perhaps in the Bronze age when they landed on our shores, but who certainly possessed and worked iron long before the Roman Conquest. In Mr. Elton's good collection of passages relating to the Kelts, such terms as golden hair, milk-white necks, snowy arms, point to their being on the whole a fair race, which tells in favour of the idea just mentioned, that the dark complexion of so many modern Irishmen and Welshmen comes from an older Silurian ancestry. This ethnological speculation is doubtful

enough, but far more obscure is the question, who were this old dark-haired race of Silurians? The author, touching on the theory connecting them with Iberians or Basques, is quite alive to the slightness of the evidence pointing this way, and not less cautious as to the ancient words belonging to præ-Keltic tribes said to be preserved in Irish or Welsh.

Mr. Elton's department of original research lies especially in ancient legal customs, on which he has for years been the leading authority at the English Bar. Indeed the desire to get back to the historical meaning of customs which the law-books utterly fail to explain, is plainly the motive which has led him into the wider investigations embodied in this book. Naturally he is always on the look-out for legal relics of the earlier inhabitants, and for instance makes a striking remark on the succession of Pictish kings being not from father to son, but to the nearest male relative traced through the female line. This custom of kinship through the mother, which still marks many of the lower tribes of mankind, did not belong to the Kelts, who shared with other Aryans the rule of descent on the father's side, and it is fairly argued that the squalid tattooed Picts were of an older race, and kept up their ruder law of marriage. Again, the ancient custom still prevailing in many English districts, in the Vale of Taunton for instance, that the land goes not to the eldest but the youngest son, is here discussed more fully than it ever has been. The author's view is that whereas in the Aryan nations the eldest son's birthright was connected, as in India at this day, with the duty of keeping up the offerings to the divine ancestors, so the opposite custom of youngest-right may have come down from the religion of some ancient race in England, where, as among the Mongols still, the youngest son was the "fire-keeper" and inherited the home. In Germany, youngest-right is frequent, and there it is on record that that quaint fetish or idol the mandrake root, dug up from under the gallows, half human in form and possessed by its familiar demon, used to descend at the house-father's death to the youngest son, on condition of his performing the pagan rite of burying bread and money in the grave. This is an interesting argument, though perhaps it may be answered that in new countries where the sons as they grow up go out and make homes of their own, the youngest son is the natural caretaker and heir of the parent's house and fields, and it is as likely that he performed the religious duties because living there made him the proper person, as that he became the heir because he had to perform the religious duties. How monuments and rites of older tribes find new and changed places in the religion of their conquerors, is here often brought into view. St. Boniface found the Frieslanders using as an altar a rude stone dolmen, probably a tomb built ages earlier by bronze-age inhabitants; the fierce Teutons would make a captive creep through the narrow opening of the upright stones, and then "sent him to Woden." After this, it does not seem surprising that our country folk should believe the rude stone dolmens on our hill-sides to have been altars for human sacrifice. Among earlier rites lasting on into Christianity, one of the most picturesque is that of Brighid the Keltic fire-god's daughter, who passed into St. Bridget, patron saint of Ireland and still name-giver to Biddy the typical Irish housemaid. But St. Bridget held to her old goddess-nature, and till the suppression of the monasteries her everlasting fire was kept up at Kildare by her nineteen nuns, who might not defile by blowing with their breath the flame sacred to the "woman of the mighty roarings"; each nun tended the fire one night in turn, but on the twentieth she who went off duty said "Brigit! take care of your own fire, for this night belongs to you." We are puzzled by Mr. Elton's remarks on the worship of Mithra, that ancient Aryan solar deity whose Oriental worship became so popular in Britain during the Roman occupation. The usually-known evidence seems to imply that the Mithra-worshippers fixed his divine birthday, the "Dies Natalis invicti Solis," on December 25, because the sun's birth would naturally be at the winter solstice, while it was not till long afterwards that this appropriate date was adopted for the Christian Dies Natalis, Christmas Day. Mr. Elton appears to take it the other way, as though the Mithra-worshippers for the sake of popularity borrowed the festival from the Christians. If he has some new evidence in this direction, it ought to be carefully gone into, and at any rate it will be well to clear the point up in the next edition.

What has now been said will give an idea of the more special researches in this important work. Readers of this journal will not disapprove of our having passed over weighty but ordinary historical topics, such as the invasions of Britain by Romans and Saxons, in order to give space for tracing lines of beliefs and customs. Some of these may seem trifling, but in the scientific study of history every trifle tells which can show a line of continuity from age to age and from race to race.

EDWARD B. TYLOR

WORKS ON THE MICROSCOPE

The Microscope and its Revelations. By William B. Carpenter, M.D., LL.D., C.B., F.R.S. Sixth Edition. Illustrated by 500 Wood Engravings and Twenty-six Plates. (London: J. and A. Churchill, 1881.)

Practical Microscopy. By George E. Davis, F.R.M.S., &c. Illustrated with 257 Woodcuts and a Coloured Frontispiece. (London: David Bogue, 1882.)

DR. CARPENTER is to be congratulated on the recent publication of the sixth edition of his very useful work on the Microscope and its Revelations, the more especially as now having the command of his own time, this edition is not only the expression throughout of his own matured views, but also contains a large amount of new matter.

A work like this which has proved itself so great a favourite needs but a brief notice at our hands. It is without doubt the book for the English reader to buy, who wishes to work as an amateur with the microscope; and should any such proceed further with the study, and penetrate into the mysteries of animal or plant life, he will find himself none the worse, but a great deal the better for the lessons he will have learnt in these pages.

The general plan of Dr. Carpenter's book is good; it begins with a short chapter on the Optical Principles of the Microscope. The question of there being a limit to the magnifying powers of the object-glasses, or whether there is a minimum behind which nothing can be seen, is not entered upon. The next two chapters—on the Construc-

tion of the Microscope and its Accessories—give a sketch of all the principal stands and apparatus in connection therewith; and is followed by two more, giving excellent directions for the management of the microscope, and for the preparation, mounting, and collecting of microscopical objects.

The second portion of the volume is devoted to an account of some of the more interesting forms of minute life to be met with, both in the animal and vegetable kingdoms. As this portion of the volume travels over a very wide field of research, so it is here that the greatest opportunities for criticism present themselves, but it is just to remark, that, despite the wonderful revolutions that have occurred in the domain of biology within the last few years, and despite the difficulty of keeping ever on a level with modern advances, a struggle only ending with one's life, Dr. Carpenter shows not only a wondrous energy, but a positive freshness in the adopting of new views. The notes on the green chromules of plant-cells are not quite up to the modern researches of Pringsheim, and we regret to find the author's sanction given to the use of the term *Gonidia* for the products of free cell-formation in the Cryptogams. The paragraph on the Nostocs might advantageously have been improved. No reason is given for uniting the Batrachospermeæ with the Florideæ. The chapter on protophyte and other fungi, seems very carefully written: the position of the myxomycetes is left doubtful, but Chlamydomyxa is brought into the same chapter. The new views on lichens are accepted, but the vacant space on the page which meets the view, might well have been occupied with a list of the algæ which play the part of hosts to the lichen fungi, which list would have proved, we think, that these forms do furnish objects of special interest, even to the ordinary microscopical worker, Dr. Carpenter's assertion notwithstanding.

It seems improbable that the antherozoids represented on page 396 as escaping from the Olpidium-like cell in the ultimate cell of the lateral branchlet of *Sphacelaria tribuloides* belong to the plant, and it is a pity that no illustration of a trichogyne is given in the account of the Florideæ, so as to call the reader's attention to what he may expect to see when looking for this special often rapidly-disappearing hair-cell. Nor is the open trichogyne in the easily procurable Coleochœta alluded to. Very scant justice is done to the Rhizocarps, and the true significance of the growth of the embryo in Lycopods appears to us to be overlooked.

Elfving's researches on the vegetative cells in the pollen-plants of the Angiosperms surely ought to have been referred to, as it opens a new and easy field of investigation to the microscopists.

The chapters devoted to those divisions of the animal kingdom which present objects of interest for microscopical research are well illustrated, and have been brought fairly up to the mark. The illustrations of Foraminifera are very good. The subject of Eozoon might perhaps have been better treated of in the chapter on geological investigation, and from the manual point of view is a little too controversial. We find no reference to the occurrence of calcareous algæ in a fossil state, and yet this is a subject which ought to command the attention of some of our microscopical workers.

Nothing that we have written must be taken as detracting from the extreme usefulness of this volume, which has for so long a period of time supplied an existing want.

Of a somewhat different type is Mr. George E. Davis's "Practical Microscopy." This author's object is to supply a book upon the lines of the late Prof. Quekett's "Practical Treatise on the Use of the Microscope," and his book treats of the forms of microscopic stand, of eye-pieces and objectives, of test objects, of section-cutting, and of the preparation and mounting of objects. In a chapter on the delineation of objects, a very detailed account is given of the subject of "photomicrography;" dry plates are preferred, and the various methods of using the camera are described, and the different modes of development are given. This volume will prove extremely useful to most practical workers, and the illustrations are both numerous and effective.

OUR BOOK SHELF

Elemente der Anatomie und Physiologie der Pflanzen. von Dr. Julius Wiesner. 276 pp.; 101 woodcuts. (Vienna: Hölder, 1881.)

THIS book is intended, as the preface tells us, to act as a syllabus or skeleton of Prof. Wiesner's lectures, thus sparing his students the labour of writing out full notes, and allowing them to give their intelligent attention to what is being said. The pretensions of the book are thus humble enough, and are, we think, well carried out.

The anatomy of plants is treated of in 153 pages, and into this space a great deal of matter is crowded. The style is simple and straightforward, and the author does not attempt to render his subject-matter easy by the slip-shod method sometimes called popular. From the nature of the book it must necessarily have somewhat the character of a catalogue; but the monotony which might be expected is not by any means a prominent fault. The numerous original drawings are from the hand of Dr. Wichmann, a pupil of Wiesner's, and are extremely well executed, though they lack the peculiar charm which we find in Sach's illustrations, and almost nowhere else. It is refreshing to meet with so large a proportion of original illustrations, instead of the usual reprints, and in this respect the book contrasts favourably with more ambitious works. How far the divisions into which the presentation of the anatomy falls will prove acceptable to professed anatomists, seems to us somewhat doubtful.

The physiological section of the book is, in some ways, probably, better than the first part, since it is the work of a physiologist in his own department. On the other hand, such a subject as physiology does not so well bear the somewhat abrupt treatment necessary in a work like the present. Again, Wiesner's standpoint in physiology is not attractive to many people, nor is it a very commonly accepted one. Few teachers, for instance, would wish their students to learn that negative heliotropism is due to the existence of negatively heliotropic elements. Yet this theory is the only one compatible with the somewhat obscure treatment of negative heliotropism here given.

Sounds and their Relations. By Alexander Melville Bell. (London: Trübner and Co., 1882.)

MR. MELVILLE BELL'S name is a sufficient guarantee of the value of his work. His *Visible Speech* formed the starting-point of those recent investigations, both in England and on the Continent, which have thrown so much light upon the nature of sounds. In spite of the many new facts which have been observed and brought together since its first publication, its importance still remains

undiminished. It was, however, as its author says, mainly intended for the students of philology; and a simpler and more practical manual, therefore, was called for by the teachers of the deaf and dumb, the missionaries in foreign countries, the elocutionists and the trainers of common school teachers, who have all made more or less extensive use of it. Their demand has, accordingly, been supplied by a clear and compact manual, in which the character, varieties, and relations of phonetic utterances are explained by the help of the symbols of visible speech. The book begins with an explanation of the symbols themselves, and then goes on to analyse and distinguish the consonants and vowels, describing their physiological formation with a clearness of language and an appeal to the eye, which ought to enable the most backward of learners to reproduce the greater part of them after a little practice. The value of this section of the manual, to those who wish to acquire the pronunciation of a foreign dialect, need not be pointed out. It is only a pity that there are no means for enabling the ear of the ordinary speaker to detect the differences of sound, which, when once written down in "visible speech," he ought to find slight difficulty in reproducing. No method, however, has yet been discovered of training the ear, as Mr. Bell has succeeded in training the physiological organs of speech. What this success is, may be judged of from the last table given in the volume, in which such elementary sounds as sobs, coughs, yawns, sneers, or even a smoker's puff, are expressed by symbols that can be at once understood, and translated into audible sounds. The fourth section of the volume contains specimens of English, Lowland Scotch, French, and German, with their ordinary pronunciation exactly noted in Mr. Bell's symbolic alphabet, whlle the last section consists of a supplementary review of the essentials of articulation, with a couple of concluding pages on "the application of visible speech to the teaching of articulation to the deaf."

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Conservation of Solar Energy

WHILE Dr. Siemens' novel and ingenious theory described in his paper before the Royal Society, and published in NATURE, will doubtless be adequately criticised in its more physical aspects by those who are better acquainted than myself with "the intricacies of solar physics," I may perhaps be allowed to point out one or two conclusions which appear somewhat opposed to the laws of mechanics. The author, for example, lays great stress upon the "high rotative velocity of the sun," which at the solar equator, according to his figures, is four and a half times that at the terrestrial equator. To this "high rotative velocity" Dr. Siemens attributes the supposed expulsion from the solar equator of the products of combustion of the gases drawn in by the assumed fan-action at the solar poles.

Mairan apparently thought the equatorial rise of the solar atmosphere due to the centrifugal force engendered by this velocity sufficient to account for the appearance of the zodiacal light, and according to Dr. Siemens his supposition may possibly be correct, if we suppose that space, instead of being an æther-vacuum, is filled with highly-attenuated gases. It seems, however, that La Place, acting on the usual supposition of an empty stellar space, calculated that the solar atmosphere could not extend more than 9-20ths of the distance of Mercury, or about 16,000,000 miles, at which distance it would exist in such a highly rarefied condition as almost to merit the designation of vacuum. That this must be so, is evident when we remember that the high superficial velocity at the solar equator, though relatively larger than that at the terrestrial equator in the proportion given by Dr. Siemens, so far from being able to exert a powerful centrifugal force, is in this respect far less effective than the smaller tangential velocity at the terrestrial equator. This is chiefly due to the counteracting influence of solar gravity, which, as is well known, is more than twenty-seven times terrestrial gravity as represented by g. It is also partly due to the large value of the solar radius, since this also enters into the denominator of the expression for centrifugal force in terms of the tangential velocity, viz. $\frac{v^2}{r}$. It is at least remarkable that Dr. Siemens has made no allusion to either of these factors, which so intimately affect the centrifugal *efficiency* of the centrifugal force—the motive-power on which the entire action depends—and has made it appear from his language that this is a mere simple function of the tangential velocity at the solar equator.

As it is, owing to these united circumstances, but mainly to the former, the ratio of the centrifugal force acting on a particle to its weight is, even at the solar equator, almost infinitesimal.

To accentuate this astronomical platitude it is only necessary to quote figures which may be found in every popular work on the sun, such as the fact that while the centrifugal force at the terrestrial equator deprives a body of 1-289th of its weight at the poles, the amount it would similarly lose at the solar equator would be only 1-18,000th. Or again, to put it in another light, in order that solar gravity and centrifugal force may equilibrate, and a particle at the solar equator be without weight, the sun would have to turn upon its axis 133 times as fast as at present, while in order that the same conditions should prevail on the earth, its rotational velocity would only need to be increased seventeen times.

Except, therefore, where they would be momentarily affected by the local expulsive forces engendered by solar combustion, the different layers of the solar atmosphere would arrange themselves in the order of their relative densities, and remain quietly attached to the surface of the sun, under an attraction fully twenty-seven times greater than that which our earth exerts on its aërial envelope. That, under such circumstances, the centrifugal force of the sun could cause it to *project* into space the products of combustion, seems most improbable.

Moreover, suppose, for the sake of argument, that this action really does take place, can it be literally maintained, according to Dr. Siemens' concluding sentence, that this action is "capable of perpetuating solar radiation to the *remotest* future"? The laws of energy tell us that work cannot be done without expenditure of energy, and since the "primum mobile" in this case is solar rotation, and the gases entering at the solar poles must gradually acquire rotational momentum at the sun's expense, they must, in time, reduce it to nought, when the supposed regenerative action would cease, and so the sun burn out. In any case, therefore, the word "remotest" can only be understood to have a limited signification.

E. DOUGLAS ARCHIBALD

[To save time we submitted Mr. Archibald's letter to Dr. Siemens, who sends the following reply.—ED.]

This letter shows that Mr. Archibald has missed the principal point of my argument concerning solar fan-action. I showed pretty clearly I thought that solar gravitation would affect the inflowing and the outflowing currents equally, and that centrifugal action must determine motion in the equatorial direction in a space filled with matter. But to put the problem into a mathematical garb let us consider the condition of two equal masses m_p and m_a, both at the radius R from the solar centre, the one opposite either pole, and the other opposite the equatorial region. The moment of gravitation of both these masses will be represented respectively by $\frac{gm_p}{R^2}$ and $\frac{gm_a}{R^2}$, and supposing both masses to be gaseous, and of the same chemical composition and temperature, they will represent equal volumes, say one cube foot.

These conditions being granted, we may put—

$$\frac{gm_p}{R^2} = \frac{gm_a}{R^2},$$

but the mass m_a is subject to another force, that produced by tangential motion, which shall be represented by v, and the centrifugal force resulting from this motion by ϕv; the moment of gravitation towards the sun will then be reduced to $\frac{gm_a}{R^2} - m_a \phi v$, and the latter factor being a positive quantity we have—

$$\frac{g m_p}{R^2} > \frac{g m_a}{R^2} - m_a \phi v.$$

This inequality of attractive moments must determine motion toward the sun in favour of $\frac{g m_p}{R^2}$, and this condition holding good for any value of g and R, it follows that the polar inflow and equatorial outflow must take place, provided only that space is not empty, as supposed by La Place, but filled with either an elastic or non-elastic fluid.

To put it in another way, Mr. Archibald imagines that in order to determine an outflow from the sun it is necessary for the centrifugal moment $m_a \phi v$ to exceed the moment of gravitation $\frac{g m_a}{R^2}$, whereas according to my view, the value of the former determines only the rate of outflow, but is immaterial as regards the principle of action. The projection of dust is entirely dependent upon the outflowing current. I leave it for Mr. Archibald to determine for himself the velocity of current necessary to move a particle of dust of given size and weight away from the sun in opposition to its force of gravity, which I am well aware is twenty-seven times that of the earth on its surface.

The gaseous current is of course produced at the expense of solar rotation, but this expenditure of energy is relatively much smaller than that lost to our earth through tidal action, and may be neglected for our present purposes. It is moreover counterbalanced by solar shrinkage as explained in my paper.

C. Wm. Siemens

Review of "Aristotle on the Parts of Animals"—A Correction

Since the publication of my review of "Aristotle on the Parts of Animals," a correspondent has called my attention to an article by Prof. Huxley, "On Certain Errors respecting the Structure of the Heart attributed to Aristotle" (see Nature, November 6, 1879), in which the Professor corrects the common error, attributed to Aristotle, of describing the heart of the higher animals as possessing three cavities only. In ignorance of this fact I assigned the merit of originally detecting the error, so long attributed to Aristotle, to Dr. Ogle, who tenders, I have no doubt quite independently, the same defence of the matter. I now write to give the priority of the detection of the error to Prof. Huxley, and to thank my correspondent for having afforded me an opportunity of studying a most original and instructive essay.

Benjamin Ward Richardson

25, Manchester Square, March 27

Deep-Sea Exploration in the Mediterranean

I shall be obliged if you will kindly announce in Nature that, taking into consideration the vote expressed at one of the plenary meetings by the Third International Geographical Congress at Venice, the Italian Government has decided that the deep-sea exploration in the Mediterranean be continued during the forthcoming summer; and towards the end of July or beginning of August next I am to embark on board the surveying steamer *Washington*, Royal Italian Navy. About one month will be devoted to deep-sea exploration under the able direction of Capt. G. B. Magnaghi, R.N.

The study of the animals collected during last year's cruise will be completed with that of those we hope to collect next summer. Since presenting my Preliminary Report to the Geographical Congress, I have looked more carefully into the fishes collected last year; amongst them are two specimens of the rare *Malacocephalus lævis*, Lowe, dredged in 508 metres off the south coast of Sardinia, and in 823 metres off Mauritius (Egadi, Sicily); and two specimens of the still rarer *Coryphænoides serratus*, Lowe, new to the Mediterranean fauna, dredged from depths of 2805 and 2904 metres off the west coast of Sardinia.

Dr. J. Gwyn Jeffreys was here a short time ago, and has examined the mollusca, on which he will report.

Henry Hillyer Giglioli

R. Istituto di Studi Superiori in Firenze, March 23

The Basque Whale in the Mediterranean

I was very much interested in Mr. Clement R. Markham's most important communication on the "Whale Fishery" in the Basque provinces of Spain, produced in Nature (vol. xxv. p. 365). Mr. Markham has carefully collected imporant materials for the history of a whale (*Balæna biscayensis*), which, if not quite extinct, appears to have become so, to all intents and purposes, in a region where it was once so common as to have given rise to an important industry, and to have had a powerful influence on the habits of the Basque people along the northern coast of Spain. Mr. Markham gives solitary instances of the appearance of the whale off the Basque coasts, up to a very recent period, and says that the last instance of its occurrence which came to his knowledge, was on February 11, 1878, when a whale was sighted off Guetaria, and successfully harpooned. This bit of news must have interested all cetologists, and I hope that it may interest Mr. Markham and the readers of Nature to know that a fine, nearly adult female of *Balæna biscayensis* was captured just one year before, in the Mediterranean, viz. on February 9, 1877, at Taranto. It was ably and fully described by Prof. F. Gasco (*Mem. R. Acad. Scienze di Napoli*, vii. 1878); the entire skeleton is in the Museum of Comparative Anatomy in the University, Naples, in the Central Collection of the Italian Vertebrata at Florence. I preserve a portion of the skin of the snout, with short hairs, and a model of the entire creature, reduced to one-twelfth, carefully executed from drawings and measurements taken from the whale immediately after death. I know of no other recorded instance of the capture of a true whale in the Mediterranean.

Henry Hillyer Giglioli

R. Istituto di Studi Superiori in Firenze

Wind Measurements

After reading the interesting article in Nature, vol. xxv. p. 486, on wind measurements, the reader cannot but revert to the very unsatisfactory state of anemometry as it now exists. This is only too apparent from the reports which appear in the papers after a gale, and in which are generally detailed the estimated pressures and velocities of the wind as recorded by the anemometers at the principal meteorological stations. Thus during the gale of the 13th-14th of October last we were told that a pressure of 53 lbs. per square foot was recorded at Greenwich, and at the Bidston Observatory, Birkenhead, the pressure reached the alarming figure of 79 lbs. Now it may be readily shown without much calculation, that such pressures as these few buildings could withstand that were not of more than ordinary stability, not to mention the destruction of tall factory chimneys, which, when of the usual dimensions, will not stand a pressure of 30 lbs. per square foot. Yet no such destruction took place. I think, then, we must confess with T. Hawksley, F.R.S. (vide paper read before Section of British Association meeting, York, 1881, on Pressure of Wind on a Fixed Plane Surface), that our present anemometrical instruments are little better than philosophical toys.

C. H. Romanes

Worthing, March 27

In the account of D'Ons en Bray's anemometer, which I printed to accompany a drawing of that instrument at the Meteorological Society's Exhibition the other day, I stated that it was probably the earliest registering anemometer. I now find that I am mistaken, but as I erred in company with the President of the Society, I feel that I may well be excused. Until a still earlier instrument turns up, the idea of a registering anemometer must be ascribed to Sir Christopher Wren. In 1663 (see Birch's "History," i. 341, plate iii.), he laid before the Royal Society an account of his "weather clock," which is in fact a recording anemometer, but for direction *only*, together with an instrument for "showing degrees of weather," probably a self-recording barometer, but the description is not clear. The spindle which drives the hour-hand of the clock carries a pinion which moves a rack, long enough to pass out clear of the case on each side. At the end of the rack there is a pencil, which bears upon a disc keyed on to the spindle of the direction-vane. The disc carries a printed diagram, a series of radial lines indicating direction, the time being shown by a number of concentric circles. The irregular line drawn by the pencil records the direction of the wind. A fresh paper is placed on the instrument every twelve hours.

Whilst upon this subject, perhaps I may be allowed to call attention to a paper by Richard Lovell Edgeworth, on wind pressure, in the *Phil. Trans.* for 1783, p. 136. It contains the results of a series of experiments undertaken to determine the variations in the pressure of the wind upon surfaces of equal area, but of different forms. This is, no doubt, the paper referred to by Robinson, as the source whence he derived the

hint of his well-known "cup" anemometer, although Edgeworth only speaks of *bending* the various pieces of metal which formed the terminations of the arms of the revolving apparatus with which he was experimenting. This paper was alluded to by the president, in the course of his address to the Meteorological Society, but in such a manner as to lead me to suppose that it was not very generally known.

May I ask when, and by whom the word "anemometer" was introduced? The earliest instance of the use of the word, with which I am acquainted, is by D'Ons en Bray, in 1734. I expect that it is of French origin. RICHARD B. PROSSER

Vivisection

IT is due to Prof. Yeo to state that while enumerating in his article on Vivisection the texts which in his opinion bore most directly upon the subject, he did not omit the case of the swine to which Mr. Stevenson alludes (NATURE, vol. xxv. p. 483). I may, observe, however, that as Prof. Yeo's argument only required to cite the texts which convey the authority of our Lord, he did not make out so strong a justification of physiological method on biblical grounds as he might otherwise have done. The whole philosophy of "scape-goats" and of animal sacrifice in general, clearly rested on the assumption that the Deity considered vicarious suffering of animals for the benefit of man, not merely to be what Lord Coleridge would term "lawful," but even desirable to the extent of rendering it obligatory on man to "shed the blood" of lower creatures for the purpose of obtaining immunity from evil.

This is not the place to consider such a topic at length, but after what has already appeared in these columns it seems worth while to observe that anti-vivisectionists would show themselves most politic by not attempting to carry their controversy into the domain of biblical ethics. The uniform opinion entertained by the canonical writers touching the importance and the rights of animals in the divine scheme of things, appears to have been that which is so tersely expressed by the Jewish Apostle of the Gentiles—"Doth God take care for oxen?"

THE WRITER OF THE ARTICLE ON "VIVISECTION"

IT is with great regret that I inform you, and through you Miss Cobbe and the readers of NATURE in general, that I have been made the victim of a *ridiculous and ill-timed hoax*. The little anecdote of Miss Cobbe which appeared in NATURE, vol. xxv. p. 459, is, it appears on investigation, quite apocryphal; yet my informant, when relating it to me, asseverated its truth so strongly, and gave me so many corroborating details, that I did not hesitate in saying that "I knew it to be true." He even ventured to "name" the celebrated vivisectionist whom Miss Cobbe was supposed to have interviewed. Therefore, when doubts began to be cast on the accuracy of my statements, I communicated with this gentleman, who informed me that the whole of this conversation between himself and Miss Cobbe is *totally imaginary* and never took place. "A fellow-feeling makes us wondrous kind," and I am sure Miss Cobbe, having been so often victimised herself, and led to believe ridiculous tales of hideous and impossible torture inflicted by high-minded, scientific gentlemen, will sympathise with me in my chagrin at finding myself a victim to my own gullibility.

May I be allowed to add, Sir, a serious postscript to my letter?

We none of us—I least of all—doubt the value of Miss Cobbe's advocacy of any cause. Had not the practice of vivisection been based on an earnest seeking after knowledge, it had surely fallen ere this before Miss Cobbe's stout blows. Now whilst we are disputing as to whether the practice of vivisection be right or wrong, a far more serious question—I had well-nigh said "crime"—is confronting us. Owing to the extraordinary demand for rare (not necessarily "beautiful") birds' skins, for the adornment of women, we are threatened with the rapid, almost immediate, extinction of some of the most wonderful species of the world's avifauna. I saw, in a milliner's shop in Regent Street, the other day, four birds of paradise, two trogons, scarlet ibises by the dozen, a rare goatsucker, kingfishers, orioles, and bee-eaters, not to mention many other birds whose greater abundance might seem to excuse their wholesale sacrifice. Now, Sir, the human race has already had to mourn the destruction of the dodo, the solitaire, the great auk, and the moa: let us not add to this list the *paradiseidæ*, the trogons, and the humming-birds. If then, Miss Cobbe will only place herself at the head of an Anti-bird-skin-wearing Association, she will find one of the most grateful and humble of her followers in your obedient servant, H. H. JOHNSTON

PS.—I take this opportunity of remarking, that I have no connection whatever, in an official capacity, with the Zoological Gardens. I headed my first letter thus, merely because it accidentally happened that I borrowed pen, ink, and paper, and wrote it there.

Tudor House, Champion Hill, S.E., March 27

YOUR correspondent, Mr. C. A. Stevenson, referring to the miraculous narrative of St. Mark, chap. v., verses 26-32, reasons to the effect that if 2000 swine were destroyed to alleviate the sufferings of a single man, then are those physiologists to be justified who, for the benefit of the whole human race, sacrifice a few animals. But, unfortunately for the argument, neither from the narrative of St. Mark, nor from those in the other gospels, does it appear that the permission given to the "unclean spirits" to pass into the swine, after their expulsion from the "demoniac," in any way contributed to his cure. On the contrary, it is distinctly implied that the demons might have been sent elsewhere than into the swine. For, according to St. Mark, they "besought" that they might not be sent "away out of the country"; or, as St. Luke has it, that they might not be commanded "to go out into the deep," that is into the "abyss," elsewhere translated "bottomless pit." Thus, it seems to be taught that when driven out of the man, the demons might have become simply disembodied spirits; and, indeed, so far as we can gather, the permission to enter into the swine was purely *ex gratiâ*.

Hence any pro-vivisection argument to be sought in the fate of the swine must, I fear, assume a form differing somewhat from Mr. Stevenson's; but which I prefer not to specify.

W. S.

AS no one has made any remarks upon the passage in Mr. H. H. Johnston's letter, in which "a distinguished man of science" is said to have twitted a lady with "wearing ostrich feathers which are plucked from the *living bird*, causing most exquisite pain," will you allow me to inform the fair portion of your readers that they may wear ostrich feathers with clear consciences if they can make sure of these having been taken from living birds, *i.e.* from those kept on ostrich farms. It used, I believe, to be the practice to pluck out the feathers; but the inflammation set up proved injurious or fatal, as must be obvious, and the life of a bird worth perhaps 60*l.* or 80*l.* was endangered for a crop of feathers worth 7*l.* or 8*l.* When the feather is quite ripe and at its best, the quill is cut with a pair of scissors or sharp knife about half an inch from the skin, and the stump moults out in the ordinary course. Probably by far the larger quantity of plumes come from tame birds. In 1878, 57,144 lbs. were exported from the Cape, and there are probably considerably more than half a million of tame birds in South Africa at this moment.

Ladies who carry their anti-vivisection consistency so far as to have serious misgivings about wearing leather boots, must still be cautious in the matter of ostrich feathers; since numbers of birds are hunted down for their plumes, although we can hardly suppose them in this case even to be plucked out while the ostrich is alive. They would come quite as easily from a dead but still warm bird, and the hunter would not be exposed to the risk of that tremendous kick an ostrich can give. I shall be glad to know on what authority birds of paradise are stated to be "skinned alive." ARTHUR NICOLS

Phænology—An Appeal

THE undersigned would urge all those who take an interest in the phænology of plants to make as many and as accurate observations as possible, and they recommend as specially suitable the following plants (the dates after the names give the mean for Giessen, calculated from many years). The observations should be made on plants standing free, plants on espaliers being excluded, and they should be made daily, accurate results being only obtained in this way.

A.—FIRST BUDS OPEN

1.	*Ribes rubrum* (red currant)	April 14
2.	*Prunus Avium* (wild cherry)	,, 19
3.	*Prunus spinosa* (sloe)	,, 20.

4.	*Prunus Cerasus* (dwarf cherry)	April 22
5.	*Prunus Padus* (bird cherry)	,, 24
6.	*Pyrus communis* (wild pear)	,, 23
7.	*Pyrus malus* (crab apple)	,, 28
8.	*Syringa vulgaris* (lilac)	May 4
9.	*Lonicera tatarica* (Tartarian honeysuckle) ...	,, 4
10.	*Narcissus poeticus* (poet's narcissus)	,, 5
11.	*Aesculus hippocastanum* (horse-chestnut) ...	,, 7
12.	*Cratægus oxyacantha* (hawthorn)	,, 9
13.	*Cytisus laburnum* (laburnum)	,, 15
14.	*Sarothamnus vulgaris* (common broom) ...	,, 14
15.	*Cydonia vulgaris* (common quince)	,, 16
16.	*Sorbus aucuparia* (mountain ash)	,, 17
17.	*Sambucus nigra* (common elder)	,, 28
18.	*Secale cereale* (rye)	,, 28
19.	*Atropa belladonna* (deadly nightshade) ...	,, 29
20.	*Vitis vinifera* (grape vine)	June 13
21.	*Tilia Europæa* (*grandifolia*) (lime tree) ...	,, 22
22.	*Lilium candidum* (white lily)	July 1

B.—First Fruit Ripe

23.	*Ribes rubrum*	June 21
24.	*Lonicera tatarica*	July 1
25.	*Sorbus aucuparia*	,, 30
26.	*Atropa belladonna*	Aug. 2
27.	*Sambucus nigra*	,, 11
28.	*Aesculus hippocastanum*	Sept. 17

Observations of the species 1, 3, 8, 11, 17, 22, and 27 are specially requested, as one of the undersigned (Dr. Ihne) is at present occupied with the preparation of a phænological map for Europe. Observations made either this year or previously, but not yet published, should be sent to one of the undersigned, and will be esteemed a favour. In what way (*inter alia*) it is possible to utilise the observations, may be understood from the comparative phænological map of Central Europe, by H. Hoffmann (*Petermann's Geographische Mittheilungen*, January, 1881.)

H. Hoffmann

Giessen, February 25 Egon Ihne

Rime Cloud observed in a Balloon

In the question whether the cloud that floated over Paris, January 25, consisted of microscopical atoms of solidified water or of minutest globules of liquid water cooled below zero, discussed under this heading in Nature, vol. xxv. p. 337, 385, 436, M. de Fonvielle adduces (p. 436) in favour of the first alternative a new argument, viz. that floating over the cloud in sunshine he has seen upon the cloud only the *corona*, and nothing resembling a rainbow, and he invokes the authority of Bouguer (1744), que "le phénomène [la *corona*] ne se trace que sur les nuages formés de gouttes de vapeur et même sur ceux dont les portraits sont glacées, mais non sur les gouttes de pluie comme l'arc-en-ciel."

I did not expect anything else. M. de Fonvielle could not see a rainbow, because the cloud certainly did not consist of rain-drops; neither could he see a rainbow, when the cloud consisted of minutest particles of liquid water.

It is a well-known fact that small particles of water suspended in air produce no rainbow. When Kratzenstein (1774) advocated the opinion anticipated by Halley (1686), that water-vapour may be condensed in a vesicular state, he availed himself of the observation, that in cloud, and mists, and the condensed steam over boiling water, a rainbow is not to be observed in reflected light.. It is not necessary to enter into the question whether the hypothesis of mist-vesicles is to be abandoned, and—as seems to me more probable—the existence of very small solid (*i.e.* not hollow) globules of liquid water is to be admitted for clouds, &c., consisting of the latter; solid water-drops, too, if their dimensions are small enough in comparison to a wave-length of light, cannot cannot produce a rainbow.

So I think it still possible that the cloud observed by M. de Fonvielle, and many mists, which have been described as consisting of ice, may have consisted of liquid water cooled below zero.

In my letter in Nature, vol. xxv. p. 385, read "Hildebrandsson's discussion of the meteorological observations made during the voyage of the *Vega*" for "Hildebrandsson's meteorological observations, &c."; and "Froströg" (*i.e.* frost-smoke) instead of "Frostzög."

Heidelberg, March 11 Hermann Kopp

Water in Australia

The extracts from Australian letters communicated by Mrs. Merrifield remind us again of the important question of water-supply in that thirsty region. Why need the crops be lost for lack of water, when accumulating evidence assures us that in the Tertiary Sandstone of the great central plain there is an abundant supply not many yards from the surface? How can the great gum trees resist the drought as they do unless their roots touch water? Several successful borings have already been made, but probably such works far inland are prevented by the scarcity of fuel for steam power. Prof. Ayrton has now, however, demonstrated that power can be generated wherever coal is plentiful, and transmitted economically and effectively by electric wire to the inland motors. It is probable that within a few years the dynamo machine will prove of more practical value to Australia than to any other country in the world. If there is any novelty or any value in the suggestion of an underground water-supply in the Australian plains, and of obtaining it by the aid of electricity, the credit is due to Mr. Thomas Blunt, of Baxter-gate, Loughborough, not to myself.

Bristol Hill, Leicester, March 25 F. T. Mott

The Solar Spectrum in a Hail-Storm

During the hail storm of Tuesday, the 21st inst., I made observations on the spectrum in various parts of the sky, and was surprised to find the orange lines of a tint decidedly deeper than that of their normal hue. When the hail ceased and the snow began to fall heavily, the lines assumed their usual colour. The rain-band at the time was strong, as might have been expected. I was not before aware that hail would exert this influence on the spectrum. The observations were made with a small pocket spectroscope. C. H. Romanes

Worthing, March 22

Temporary Retinal Effects

In your present week's "Notes" you have referred to the curious experiences of MM. Macé de Lepinay and Nicati, in finding the town lights appear green, after five hours among snow-fields. On the Cima di Jazi, some 16,000 feet or more high, I found another effect. On removing my blue snow-glasses, the sky (at about 10 a.m.) appeared of the deepest indigo colour, while the sun could be looked at without pain, and resembled a harvest-moon close to the horizon, of a red yellow tint, and with a well-defined outline. The effect disappeared as we descended the mountain. As another instance of temporary affliction of the retina, I had been using on the sun, as examined with an 8¼-inch reflector, a miniature spectroscope with fine slit, notwithstanding which the spectrum was very bright. Some hours (not immediately) after, all the gas lamps, candles, &c., appeared of a blood red, and so continued for some hours. This effect still persisted at dinner-time, but gradually and entirely passed off during the meal. No trace of green tint was, in this case, seen. In the sun-glare it is not uncommon with some persons, to find leaves and other small objects on the path, of a red tint. J. Rand Capron

Guildown, March 25

Specific Heat and Thermal Conductivity

Prof. Tyndall, in his lectures on "Heat a Mode of Motion," p. 255, gives a highly-instructive experiment to illustrate the influence of the specific heat of a substance in masking its thermal conductivity. Short prisms of iron and bismuth, having their upper ends coated with wax, are placed upon a vessel of hot water, and the wax is observed to melt first upon the bismuth, in spite of its comparatively low conductivity.

I should like to ask whether others have been uniformly successful in obtaining the above result, at any rate when the bismuth and iron prisms are soldered to the top of the hot water vessel; for this seems to me necessary in order that the experiment may be made with absolute fairness, and independently of any want of uniformity of polish and flatness in the surfaces between which the heat has to pass.

I have tried with cylinders of nearly pure bismuth and best bar iron of various lengths (from 1 cm. to 5 cm.) and diameters, brightly polished, and in some cases wrapped in vulcanised india-rubber, to avoid loss of heat by radiation and convection, and I invariably find that the wax melts upon the iron first.

Moreover, on turning to the tables of conductivity and specific heat, I find for iron and bismuth—

	Iron.	Bismuth.
Ratio of thermal resistances	1 ...	6
,, specific heats	3·7 ...	1

The theoretical resultant effect would seem to be indicated by compounding these ratios, which would still leave a decided balance in favour of iron.

It seems doubtful whether the law, distance of point of equal temperature from source $\propto \sqrt[2]{\text{conductivity}}$, holds good in the case of bad conductors, and in any case it only applies when all parts of the bar have attained a constant temperature.

I must apologise for asking for information on so small a matter, but I should especially like the experiment to succeed if Nature will kindly permit it. At the same time, I hope that I shall not be accused of undue pessimism if I say that, according to my experience, the work of a natural science lecturer is simply a perpetual struggle against the malice of Nature.

Eton College, March 18 H. G. MADAN

Rookeries

CAN any of your readers kindly inform me how to establish a *rookery*. I have tried putting old nests into high elm trees, but they have not been taken to, although rooks are often in the trees. THE MUG

Trueloves, Ingatestone, Essex, March 21

A Means of Saving some Lives in Colliery Explosions

WHATEVER brings about an explosion in a colliery, it appears that men often perish thereby not from burning, nor from injury, but from want of fresh air. It would now be easy, or might soon become so, for every collier, at a small cost, to keep near him always when at work, a little vessel full of compressed air, which being provided with a rather fine nozzle, and a stop-cock, and a small piece of india-rubber tube, might be a sufficient deliverance for him in the moment of need, should he in an explosion have escaped violent injuries. D. RHYS JONES

Carmarthen, March 24

ECONOMIC GEOLOGY OF INDIA[1]

I.—*Precious Stones and Metals*

THE concluding volume of the Manual of the Geology of India was issued from the Calcutta Press towards the last days of 1881, and a supply of copies may now any day be expected to arrive in London. This volume, published by order of the Government of India, brings to a worthy conclusion a most remarkable work, in which we find a general geological sketch map of nearly the whole of India, a descriptive account of its various formations, and a history of those geological products therein found which are of importance to mankind. When we stop to think of the immense area explored, of the enormous amount of details that had to be collected and sorted, of the dangers and trials which were encountered during the investigation of much of the country that had to be explored, we confess to being struck with amazement at the energy, zeal, and courage of the comparatively very small staff employed by our Government in this service, and we feel sure that those labouring in European or American fields will be the first to acknowledge how much is owing to the Geological Survey of India for the quality as well as the quantity of the work done by them in the plains of Asia.

But it is not only the geologists that will find an interest in this the third volume of the Manual. It treats of the economic products of the geological formations of India, and has a far greater interest even for the statesman than for the scientific man, and an interest too for the commercial man and the general reader, nay even more, there is much of interest in this volume for the student of history, for the student of mankind, about the origin of myths, and about the gradual development of the arts of working in iron and gold.

This volume is written by Prof. Valentine Ball, who was, until recently, officiating deputy Superintendent of the Geological Survey of India; an author well known by his pleasant record of many years' work in India, not long since published under the title of "Jungle Life in India," and one who, by many years' assiduous and patient labour as one of the Survey Staff, was fully qualified for the great task so well accomplished in this work. Not only has he brought together in this volume a great store of facts collected by others, but from his own personal knowledge of localities and details, he has been enabled to arrange these facts in orderly sequence in a way few others could have attempted, and he well deserves the high commendation of his chief, the Superintendent of the Survey, who writes: "The student, as well as the man of enterprise, will long owe him gratitude for what he has thus brought within their easy reference."

To give our readers an idea of the contents of this volume, we propose to treat of them in a somewhat arbitrary fashion. In this notice we would call their attention to the Precious Stones and Metals of the East. In a second notice to treat of its Iron and Coal resources, and of the important subjects of its Salt supply and Building Stones. It will not be in any sense our object to treat these subjects in an exhaustive manner, but to indicate to the reader what he will find in the 600 large octavo pages of this work, which is illustrated with numerous maps, lithographic plates, and woodcuts.

The diamond is the most important of the precious stones of India; it can be traced back to Sanscrit literature, in which the first mention of its actual localities is to be found. The famous Koh-i-nur is stated to have belonged to Karna, the King of Anga, about 5000 years ago; but this is not founded on any very reliable evidence. Tavernier and Marco Polo allude to a trade existing in diamonds between Asia and Europe, and before the first diamond mines in Brazil were opened (1728) nearly the whole supply of the old world went from India. There are in India three extensive tracts, widely separated from each other, in which the diamond is known to occur. Besides these principal tracts there are others where diamonds have been found, but precise details are wanting. The most southern of the three great districts has long borne the familiar name of Golconda, though Golconda itself never produced diamonds, and is in fact merely the mart where they were sold and bought. In this southern tract, which is in the Madras Presidency, either are or have been the mines of Kadapah, Bellary, Karnul, Kistna, and Godavari. The second great tract occupies a considerable area between the Mahanadi and Godavari rivers. The third is situated in Bundelkhand, near one of the chief towns of which, Panná, some of the principal mines are situated. In Northern India the diamonds, when found *in situ*, are in a conglomerate which is referred to the Rewah group of the Upper Vindhyan formation, while in Madras they are found under the same circumstances in the Banaganpilly sandstones, which form the base of the Karnul formation.

In connection with this geological position it is interesting to note that these Vindhyan rocks of India have been correlated with the diamond-bearing rocks of the Cape Colony in Africa. The examination of the diamond-bearing strata of India seems to throw no light on the as yet unsettled question of the conditions under which the crystallisation of carbon took place, which resulted in the formation of this precious gem, though synthetical operations in the laboratory seem to tend towards confirming Liebig's view, that it has been formed by crystallisation from a liquid hydrocarbon. It must however be remem-

[1] "A Manual of the Geology of India. Part III. Economic Geology." By V. Ball, M.A., F.G.S., Officiating Deputy Superintendent, Geological Survey of India. Published by order of the Government of India. (Calcutta, 1881.)

bered, in treating of this part of the subject, that it is still a matter for doubt if the diamond in India has ever been found in its *original* matrix. The lowest diamond-bearing stratum at the base of the Karnul series is itself a detrital conglomerate, and it is not unreasonable to suppose that the diamonds in it may, like the other ingredients, have been derived from some older metamorphosed rocks.

Very copious details are given as to the various mines and as to their respective produce. The history of the great Mogul diamond is narrated, and the conclusion come to that it is probably now in part represented by the Koh-i-nur. As a practical application of known facts, the prospect of diamond mining in India under European direction is dismissed as unprofitable. With scientific guidance, backed by capital and proper mining appliances, it might at first appear that mining by Europeans ought to succeed, but on a closer investigation it will be gathered that there are in diamond-mining certain peculiarities which distinguish it from most, if not all, other forms of commercial enterprise; and as a principal of these the facilities for peculation in consequence of the readiness with which the gem can be secreted, must be reckoned. Furthermore, it would almost seem that, except under a system of slavery, the diamond cannot be worked profitably in India. The present system, though not so called, practically amounts to slavery; the actual miners are by advances bound hand and foot to the farmer of the mines, and these are content to wait for months together without any return; their outlay being very small, and there being no heavy expenditure of capital required.

The myth regarding diamond-seeking, made so familiar to every one by the travels of Marco Polo and Sindbad the Sailor is of great antiquity.

"Perhaps one of the best accounts of it is by Nicolo Conti, who travelled in India in the early part of the fifteenth century. He says that at a place called Albenigaras, fifteen days' journey north of Bizengulia, there is a mountain which produces diamonds. This Albenigaras might be Beiragarh, the modern Wairagarh; that it was so is doubtful, but its identity is perhaps immaterial. Marco Polo undoubtedly referred to the localities in the Kistna Valley. Nicolo Conti says that the mountain being infested with serpents it is inaccessible, but is commanded by another mountain somewhat higher. 'Here at a certain period of the year men bring oxen which they drive to the top, and having cut them into pieces cast the warm and bleeding fragments upon the summit of the other mountain by means of machines which they construct for the purpose. The diamonds stick to these pieces of flesh. Then come vultures and eagles flying to the spot, which seizing the meat for their food fly away with it to places where they may be safe from the serpents. To these places the men afterwards come and collect the diamonds which have fallen from the flesh.' He continues with an account of how other less precious stones are obtained, and this part of his description is that of ordinary Indian diamond-mining. Allusion has been made to the native belief that the diamond mines were under the special patronage of the goddess Lakshmi, and that sacrifices were made to propitiate her. There is reason for believing that sacrifices were made on the opening of new mines, and probably also when the supply of diamonds ran short.

"The late Mr. M. Fryar, when visiting a stream-tin washing at Maleewoon, in Tenasserim, was requested first to remove his boots, being told that on a former occasion a European visitor insisted on walking up to the stream with his boots on, and that in consequence it ceased to yield ore until two buffaloes had been sacrificed to appease the insulted guardian spirits of the place.

"This is scarcely a suitable place for fully illustrating this subject, but the following, if put side by side with Nicolo Conti's account, so completely explains it that it will perhaps be sufficient for present purposes.

"Dr. J. Anderson, in his recent report on the expedition to Yunan, describes having witnessed the sacrifice of two buffaloes by the Kakhyens to the Nâts or evil spirits. The animals having been slaughtered on two bamboo altars were cut up and the meat distributed, *certain portions with cooked rice being placed on a lofty bamboo scaffolding for the use of the Nâts.* It goes without saying that birds would help themselves to these offerings.

"Credulous travellers in early times might very possibly have supposed, on witnessing such a preliminary sacrificial rite, if at a diamond mine, that it was an essential part in the search for diamonds, and it would not require any very great stretch of Oriental imagination to build up the fable on such a substratum of fact. The bamboo scaffolding in all probability represents the machine mentioned by Conti."

Graphite or plumbago, as found native, contains from 90 to 99 per cent. of carbon. The only deposit in India, with the possible exception of another at Vizagapatam, which seems of any present promise is that which occurs over a wide tract in Travancore. At the present day nearly all the plumbago of commerce comes from Ceylon.

Of the precious metals Platinum occurs in very minute quantities, with gold-dust, and has been probably derived from metamorphic rocks.

Silver is found associated with gold, and in combination with sulphur, and as a sulphide it is often associated with sulphide of lead, antimony, &c., but the amount of silver produced over the peninsula is very small.

Gold is met with very generally distributed over British India. The ultimate derivation of most of the gold of Peninsular India, is doubtless from the quartz reefs which occur, traversing the metamorphic and submetamorphic series of rocks; but there is also evidence to show that in some parts of the country gold occurs in certain chloritic schists and quartzites, and possibly also in some forms of gneiss, independently of quartz veins. As to the relative productiveness of the reefs in the different groups or series of metamorphosed rocks, the imperfect evidence which at present exists is somewhat conflicting, the truth probably being that no one rule holds applicable to the whole of the country. The presence of gold, either as an original deposit, or as a detrital product from the older rocks, has not as yet been proved in any member of the great Vindhyan formation; but in the next succeeding formation several of the groups included in the Gondwana system are believed to contain detrital gold; of these the evidence seems clearest in the case of the Talchir. It is almost certain that the gold obtained in the Godavari, near Godalore, is derived from rocks of Kamthi age, and the gold of the Ouli River, in Talchir in Orissa, is derived from sandstones. The only other sources in Peninsular India are the recent and sub-recent alluvial deposits, which rest on metamorphic or sub-metamorphic rocks. In the Extra Peninsula districts gold is met with in rocks of several different periods. In Ladak certain quartz reefs, which traverse rocks of the Carboniferous period are gold-bearing. In Kandahar gold occurs in rocks of Cretaceous age, and the deposit seems to be an original one, connected with an intrusion of granite. Lastly, all along the foot of the Himalayas, from west to east, from Afghanistan to the frontiers of Assam and Burma, the tertiary rocks which flank the bases of the hills, and which occur also in the Salt Range, and at Assam, south of the Bhramaputra, are more or less auriferous, but the gold is detrital.

The history of gold mining in India is lost in a very remote antiquity. Vast amounts of bullion were carried away by the Moslem armies of the fourteenth century. Some would place the Ophir of King Solomon on the west coast of India, and much of this precious metal as has been already collected from the golden sands of the

peninsula, it is possible that much more remains. Quite recently the gold fields of Madras have attracted a great deal of public interest, and a large amount of capital is being diverted to their exploration. For writing a history of British gold mining in India the time has not yet come, and we can only hope with Prof. Ball "that the actual results of this enterprise may come up to the high standard of success which has been predicted for it."

Amidst a variety of most interesting details as to the various gold diggings and gold workings in India, we select the following account of the Thibetan Gold Mines, which for many centuries and to the present day, send a regular supply of gold to India.

"Of the very highest interest are the accounts of the Thibetan gold mines, which are given by the Pundits attached to the Indian Survey for the purpose of exploring countries north of the Himalayas. Unwittingly these admirable native servants of the Government of India have furnished facts which have enabled Sir Henry Rawlinson, and independently Prof. Frederic Schiern, Professor of History at the University of Copenhagen, to clear up a mystery which has been a puzzle to the historians and philosophers of many countries for upwards of 2000 years. A translation of Prof. Schiern's paper,[1] by Anna M. H. Childers, will be found in the 'Indian Antiquary.[2] It is a most remarkable example of learned research, and one very difficult to give in abstract. It is entitled 'The Tradition of the Gold-digging Ants.' But perhaps before giving the conclusions which Sir Henry Rawlinson and Prof. Schiern have arrived at, it will be best in this place to briefly describe the Pundits' observations :—

'During the expedition of 1867 the Pundit who had been at Lassa fell in at Thok Jalung, an important gold-field in the province of Nari Khorsam, with a large encampment of Thibetan miners, and took the opportunity to gain information relative to the working of the mines. In the third expedition, in 1868, another Pundit passed on as far as Rudok, at the north-west extremity of Chinese Thibet on the frontier of Ladak, and on his way back from Rudok visited the gold-fields of Thok Nianmo, Thok Sarlung,[3], and Thok Jarlung. The map which accompanies Major Montgomery's narrative of the journeys of the Pundits gives in addition the gold-fields of Thok Munnak, Thok Ragyok, Thok Ragung, and Thok Dalung.' . . . . 'The miners' camp at Thok Jarlung, according to the measurements of the Pundits, is 16,300 feet above the sea-level.

'The cold is intense, and the miners in winter are thickly clad in furs.

'The miners do not merely remain under ground when at work, but their small black tents, which are made of a felt-like material, manufactured from the hair of the Yak, are set in a series of pits, with steps leading down to them . . . seven or eight feet below the surface of the ground.' 'Spite of the cold the diggers prefer working in winter; and the number of their tents, which in summer amounts to 300, rises to nearly 600 in winter. They prefer the winter, as the frozen soil then stands well, and is not likely to trouble them much by falling in.'

"They are occasionally attacked by bands of robbers, who carry off their gold.

"Sir Henry Rawlinson's remarks on these reports of the Pundits' researches and travels are as follows :[4]—

"'Now, then, for the first time, we have an explanation of the circumstances under which so large a quantity of gold is, as is well known to be the case, exported to the west from Khoten, and finds its way into India from Thibet; and it is probable that the search for gold in this region has been going on from a very remote antiquity, since no one can read the ex-Pundit's account of Thibetan miners 'living in tents some seven or eight feet below the surface of the ground, and collecting the excavated earth in heaps previous to washing the gold out of the soil,' without being reminded of the description which Herodotus gives of the 'ants in the lands of the Indians bordering on Kaspatyrus (or Kashmir) which made their dwellings underground, and threw up sand heaps as they burrowed, the sand which they threw up being full of gold.'

"Prof. Schiern points out that the tradition was mentioned in writings of the middle ages, and those by Arabian authors It survived among the Turks. Strabo and Albertus Magnus treated the whole story as a fiction. Xivrey supposed that the animals had become extinct owing to the *auri sacra fames*. Major Rennell supposed that the dwellers in mounds were *termites* or white ants. Humboldt's observations in Mexico on the habit of certain ants to carry about shining particles of hyalith was quoted by those who believed that the animals were really ants. Other authorities suggested that they were marmots, jackals, foxes, or hyænas. Pliny having stated that horns of the Indian ant were preserved in the temple of Hercules at Erythræ, Samuel Wähl, who maintained the hyæna theory, proved equal to the difficulty by suggesting that the horns might have been a *lusus naturæ*. Prof. Schiern ingeniously argued that the horns had been taken from the skins of animals which formed the garments of the miners. It seems possible, however, that they were samples of the pickaxes made of sheep's horns, which, as is mentioned above, are used to the present day by the miners in Ladak.

"Prof. Schiern further points out that ancient writers say that the ants worked chiefly in winter, and connects this with the statement of the Pundit above quoted.

"In conclusion he writes :—

"'For us the story partakes no longer of the marvellous. The gold-digging ants were originally neither real ants, as the ancients supposed, nor, as many eminent men of learning have supposed, larger animals mistaken for ants on account of their subterranean habits, but men of flesh and blood, and these men Thibetan miners, whose mode of life and dress were in the remotest antiquity exactly what they are at the present day.'"

The quotations that we have given will show the general reader what he may expect to find in this volume, in addition to the more scientific accounts of the several diamond and gold mines.

(*To be continued.*)

[1] Verhand Kgl Danischen Gesellsch. der Wissensch. for 1870. Printed separately in Danish, German, and French.

[2] Vol. iv. p. 225.

[3] Thok Sarlung had at one time been the chief gold-field of the district, "but had in a great measure been abandoned on the discovery of the Thok Jarlung gold-field. The Pundit passed a great excavation some 30 to 40 feet deep, 200 feet in width, and two miles in length, from which the gold had been extracted."—*Jour.* As. Soc., Bengal, vol. xxxix., Pt. 2, p. 53, 1870.

[4] *Pall Mall Gazette*, March 16, 1869, quoted in "Indian Antiquary," p. 225.

PRECIOUS CORAL

WHILST preparing a set of lectures on Corals, lately delivered at the Royal Institution, I made some inquiries as to the present state of the fisheries of precious coral from Messrs. Greck and Co., coral merchants, of Rathbone Place, who also have an establishment at Naples. They exhibited a very fine series of examples of raw and worked coral at one of my lectures, and also sent me the following short notes on the Italian and Sicilian coral fisheries, partly taken from an Italian newspaper, but which contain some facts which may be interesting to the readers of NATURE. I was shown a large number of the Sciacca specimens, all attached to groups of bivalve shells or pieces of dead coral. The blackened coral is described by Lacaze Duthiers in his famous monograph as "corail noirci dans la vase." It is very possible that the blackening substance is binoxide of manganese, since we dredged, in deep water during the *Challenger* Expedi-

tion, large quantities of a dead coral skeleton, apparently allied to Corallium, which was blackened by that substance. It is in the hope of eliciting some definite information from the readers of NATURE concerning the so-called Japanese Corallium that I send the present notes. At a late meeting of the Zoological Society, Mr. G. O. Ridley, of the British Museum, read a paper on the Coraliidæ, and reviewed the species known, and exhibited specimens of the form said to come from Japan. I obtained specimens of this corallium from Mr. Cutter, the London dealer, from whom I first learned that a precious coral was called Japanese. He told me that he had seen a large quantity in the market in London, but that it would not fetch any price, whereas Messrs. Greck state that Japanese coral sold for an extremely high price in Italy. Messrs. Phillips, of Cockspur Street, who also exhibited a fine series of specimens of precious coral at one of my lectures, showed amongst them a carved jewel cut out of Japanese coral, which is remarkable as being of mixed colour, marbled white and red, and also, as they informed me, for its far greater hardness than ordinary precious coral.

Now although this coral, which is of a named species, is evidently universally regarded in the trade as Japanese, all evidence available seems to prove that no precious coral occurs in Japan. The *Challenger* did not meet with any ; and though I inquired, I heard of none as dredged there. Moreover, in numerous Japanese illustrated works on the races of men, certain foreigners of some kind are represented as bearing in their hands precious coral as tribute, or as the staple produce of their country, thus showing apparently that the coral is regarded as something rare from abroad in Japan. Perhaps, some of the correspondents of NATURE in Japan can state whether any corallium occurs in Japanese waters. H. N. MOSELEY

Extract from the letter of Messrs. Greck and Co. :—

"Coral fisheries on the coasts of Italy and Sicily begin about the middle of February, and continue till the middle of October. The value of the coral fished up varies immensely according to its colour and size ; the pale pink is the most prized, especially if it be of a uniform colour throughout, without stains. Off Torre del Greco, near Naples, a large quantity of coral is found every year ; from 400 to 600 boats are sent out in search of it, each boat being of from six to ten tons' burden, with a crew of at least twelve men, and costing from 500*l.* to 600*l.* a boat. Nearly all the inhabitants of Torre del Greco are employed by this industry, either as fishermen or in the manufacture of the coral brought to shore. The valuable pink coral is found chiefly off the coast of Sicily : in the year 1873 a bed was discovered in the Straits of Messina, in which the coral, though found only in small quantities and of a small size, was of immense value, owing to its beautiful pink, of a uniform colour, and without any of those stains which detract so much from its worth. The coral found in this place is sent chiefly to London and Birmingham ; it is usually manufactured in the shape of 'lentils,' and in this form is largely used for rings, either set singly in half-hoops or surrounded by precious stones and pearls. Its value varies from 80*l.* to upwards of 200*l.* per ounce.

"Unfortunately the supply of coral in this bed seems to have run short, and for the last few years coral-merchants have not found it worth their while to send boats in search of it. The last attempt was made last year by the firms of Criscuolo and Greck and Co., who despatched two boats with a crew of thirty selected men, but the find was so small as barely to pay the expenses of the outfit.

"This year out of 800 boats employed in the coral-fishery off the coast of Sicily, not one has been sent to the bed in the Straits of Messina. In 1875 a local bed was discovered about twenty miles off the coast of Sciacca in Sicily, which was invaded for the next two years by 700 boats. This number of boats all crowded together in one spot, caused great confusion, and the Italian Government despatched a man of war to keep order among the fishermen. Another similar bed was discovered in 1878, about ten miles further from the coast, and in 1880 yet another still further, to which 600 boats were sent, and we learn from the reports of the Custom House at Sciacca that in a few months about 8000 tons were fished, and although the quality of the coral is very inferior, being of a reddish colour and often quite black, its value is computed at several millions of pounds. The coral found off the coast of Sciacca does not grow as at other places attached to rocks, but is found clinging to any small object it can lay hold of, such as a shell, or a fragment of coral. It is supposed that its dark red or black colour is caused by the muddiness of the water in which it lives, although the depth of the sea at such spots is from 300 to 450 feet. This coral is not much esteemed in the English market, but is prepared in large quantities for the Indian market at Calcutta, by being exposed for months to the heat of the sun, and by being kept moist, when in time the black colour gradually disappears.

"A few years ago a large quantity of Japanese coral found its way into the market at Naples, and fetched as much as 150*l.* the kilo. in raw branches, in spite of its being a bad colour and somewhat cloudy. This high price was given on account of its extraordinary size. It is the largest real coral ever known. Nothing has been heard of it since, excepting that the fishery was prohibited in Japan."

MAXIM'S SELF-ACTING FIRE-EXTINGUISHERS[1]

HOWEVER certain it is that fires in theatres will never be completely suppressed, we may still hope by energetic measures and systematic arrangements to lessen both their number and their danger, and it is scarcely probable that we shall ever again have to record such a catastrophe as that of the theatre at Nice or the Ring Theatre at Vienna. The preventive measures to be taken against a dangerous fire which may break forth at any moment are twofold—moral and material. The moral measures unfortunately do not admit of immediate or easy application. The public must be educated, and, as it were, familiarised with the danger, by being shown the precautions taken, the most direct escape available in case of fire, so as to avoid or rather diminish the terrible results due to the crush of a mass of frantic people precipitating themselves at the same moment into the outlets during the frightful struggle for life which accompanies the slightest panic. In short, the instinct of self-preservation must be so methodised as to be rendered most efficacious. Lamps, notices to indicate the way out, widening the passages and corridors, increasing the number of outlets and staircases, &c., are all useful measures which are now being actively carried out.

In addition to these measures, whose special object is to lessen the number of victims, when it is impossible to stay the progress of the fire, there are others directed against the fire itself, by checking its advance, or strangling it, as it were, in its very birth. The stage is undoubtedly the most dangerous point, from the very nature of the materials composing it. With the decorations constantly exposed to blazing jets, it seems miraculous that accidents are not more frequent, and it is therefore upon the stage principally that the measures for fire-extinction are to be brought to bear ; it is also important that they act instantly ; for it is always more easy to obtain the mastery over a fire towards its commencement, before it has had time to develop into an incurable evil. The remedy, moreover, will often come too late, if its application depends on those who are on the stage, because they themselves, frequently under the influence of

[1] From *La Nature*.

premature panic, or being too remote from the point attacked by the fire, reach it only too late to arrest its progress.

Under those circumstances M. Maxim thought it advisable to make use of *self-acting* measures; and for that purpose has formed a combination of very ingenious appliances, the principle of which he now proposes to explain.

M. Maxim's proposal is to institute such a preventive system that, as soon as a fire begins to show itself at any given point of the stage, the accident will itself produce automatically and instantaneously a series of mechanical movements sufficient to flood the threatened part with water, and arrest the progress of the fire. These movements are produced either by the mechanical action of

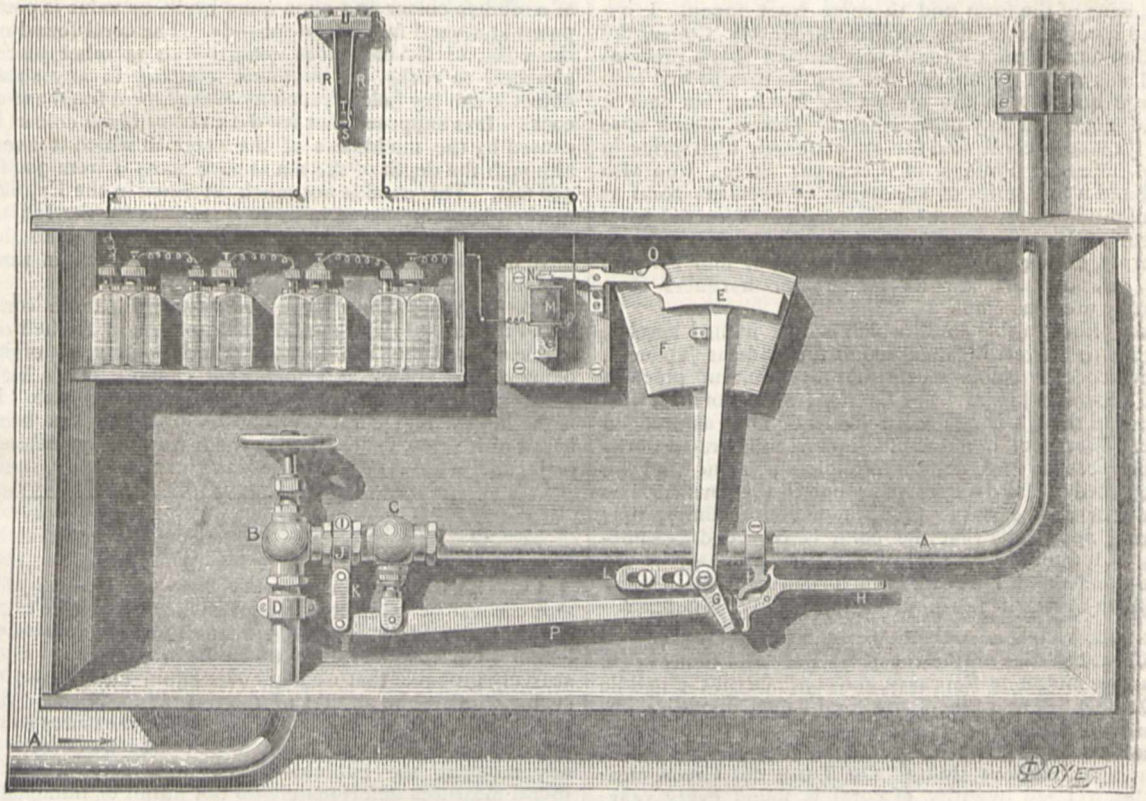


FIG. 1.—Apparatus closing the circuit and opening the tap.

levers, or by electricity; and we proceed to examine the two systems separately.

Mechanical System.—The part over the stage, and the spaces beneath it, the side-wings, and the ceiling-decorations, are traversed by a network of pipes of different diameters suitably distributed. These pipes are all connected with a common pipe in communication with the main water-supply of the town. In the usual condi-

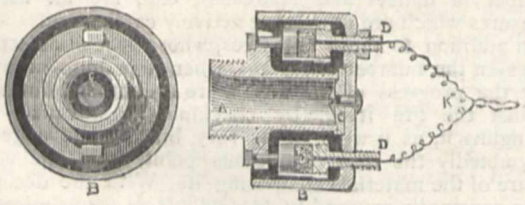


FIG. 2.—Opening of a pipe by burning a string.

tion, the system of pipes about the stage is full of air slightly compressed, and the supply-cock is closed. At regular intervals cocks are placed on the pipes and kept also closed by means of small levers, each of which is held in position by a string drawn tight, and fastened to a point at a suitable distance from the corresponding escape-cock. As soon as the fire shows itself at any given point, by the burning of one or more of the strings, the levers are set free, and thus open the corresponding escape-cock, and allow the compressed air to escape from the system of pipes. This depression of the compressed air lowers a valve, which sets free a weight acting on the supply-cock. The latter being thus opened, the water from the main passes throughout the system of pipes, and is at once discharged by the openings corresponding to the strings which have been burned. Thanks to this

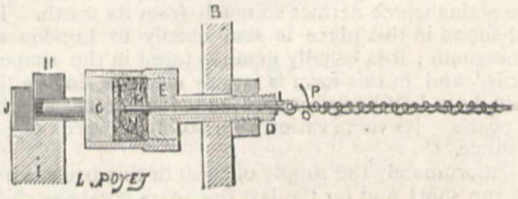


FIG. 3.—Opening of a pipe by the passage of a current of electricity.

arrangement, a simple movement, caused by the rupture of a combustible string, is sufficient to act upon all the discharge-cocks, flood the part which is in danger, and prevent the fire from spreading.

To cause a discharge of water at any given point, M. Maxim also makes use of short combustible strings, so hanging, that when set on fire they cause an explosion of a little gun-cotton placed in a sort of a cap, which shuts

the mouth of the discharge-pipe. The cap being blown off, the air escapes, and thus, by the arrangements already described, the water discharges by the opening made by the explosion. This string-arrangement, however, is not free from objections. In scene-shifting, for example, some of the strings might be broken, opening the discharge-cocks, and thus flooding the men employed, and causing a false alarm and useless waste. That objection is entirely avoided by the electric system.

Electric System.—In this self-acting extinguishing ap-

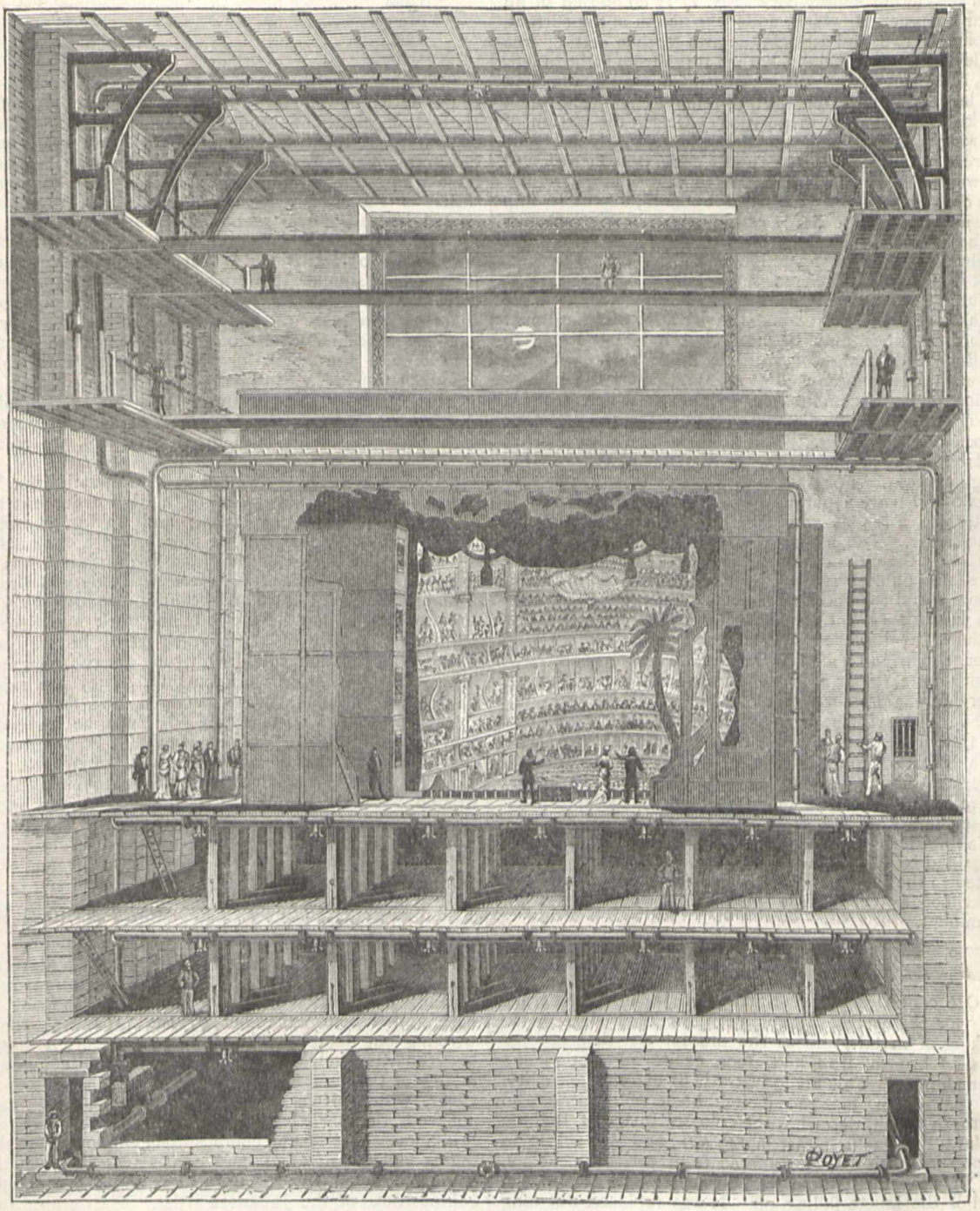


FIG. 4.—Arrangement of system of pipes above and below the stage.

paratus, the network of pipes is the same as in the mechanical system, but they are not filled with compressed air. The system, as a whole, is composed of three distinct parts:—(1) an apparatus which completes the electric circuit, under the action of the raising of temperature caused by the fire; (2) a self-acting supply-cock, to send water into the system of pipes from the main pipe in the street; (3) an arrangement for opening the discharge-pipes upon any part which is in danger.

The apparatus (1) for completing the electric circuit is

extremely simple. It is composed (Fig. 1) of two metallic plates, R, R, forming springs, and separated by a small piece of fusible metal, S, which is isolated from the plates by paper, or any other isolating body. The heat caused by the fire melts the metal, and the plates coming into contact, the electric acts upon the automatic supply-cock. This self-acting supply-cock (Fig. 1) is composed of an electro-magnet, M, which, under the action of the current, becomes active, and attracts the arm N, thus setting free the lever, E. The weight, F, then turns from right to left, and, after describing the quarter of a circle, falls upon the lever, H, whilst the part, G, removes a check which has kept the lever, P, in position. Under the action of the weight, F, and by means of the lever, P, which has its fulcrum in the point, J, the supply-cock, C, is turned, and the water rushes into the pipe, A, to be discharged above. The cock at B, which is worked by hand, serves to stop the supply when the fire is extinguished, or when repairs are being made. Under ordinary circumstances, it must be always open, else the action of the automatic supply-cock would be of no effect.

The water pouring upwards into the pipes ought to be discharged at the point where the fire appears. Ordinary perforated pipes may be used, but it is preferable to localise the discharge of water by the explosion of gun-cotton. This is produced (Fig. 2) either by the inflammation of very combustible strings K, which set fire through D to some gun-cotton placed in the small pistons B; or electrically (Fig. 3) by a fine platinum wire N being rendered incandescent by the current, and thus exploding the gun-cotton. For this purpose the two conducting wires O and P are separated by an insulating combustible matter and a fusible conductor, resembling those of M. Charpentier. The increase of temperature accordingly completes the circuit and causes the explosion. When there is no public supply of water, as in small towns, M. Maxim would then utilise the electric current as follows:—The weight F (Fig. 1) when set free falls on a bottle of sulphuric acid placed over a reservoir half filled with water, containing a certain proportion of lime. A large quantity of carbonic acid being thus produced in a closed reservoir, the pressure forces the water inio the system of pipes. Fig. 4, the section of a large theatre, shows how the system of pipes may be disposed around the stage. Such, substantially, are the principles of M. Maxim's apparatus for preventing fires in theatres and places where people assemble in numbers, such as large warehouses, hotels, &c.

Taking the most impartial view of the advantages to be gained by this apparatus, we hope it will soon be submitted to the test of experience, while desiring there may never be any occasion of making its effectiveness too prominent.

ART METAL WORK OF JAPAN

FOR centuries past the artists of Japan have earned for themselves a reputation for their skill in the working of metals, and at the present day their productions in bronze, iron and steel, excite admiration and astonishment. This art industry is of extreme antiquity. Mr. Satow, in his recent handbook of Central and Northern Japan, describes the colossal image of Buddha at Nara It was first cast in 749 A.D., and was set up in its present position. It suffered from various accidents, and in 1567 the temple was burned to the ground, the head of the image falling off. It was replaced not long afterwards, and we may therefore assign to the body an age of 1140 years, and to the head about 300 years. Buddha is represented seated cross-legged on a dais which is of bronze, and represents the calyx of a lotus. The figure is 53½ feet high; the face is 16 feet long, and 9½ wide, while 966 curls adorn the head, around which is a halo 78 feet in diameter, on which are images 8 feet in length. A roof protects the image, and a staging is erected to assist visitors in examining it. The casting is said to have been attempted seven times before it was accomplished, and 3000 tons of charcoal were used in the operation. The whole is said to weigh 450 tons, and the alloy is composed of:—

Gold	...	...	...	500	lbs.
Mercury	...	...	...	1,954	,,
Tin	...	...	...	16,827	,,
Copper	...	...	...	986,080	,,

"The body of the image and all the most ancient part of the lotus flowers on which it is seated are apparently formed of plates of bronze 10 inches by 12, soldered together, except the modern parts, which are much larger castings. A peculiar method of construction is said to have been adopted, namely, of gradually building up the walls of the mould as the lower part of the casting cooled, instead of constructing the whole mould first, and then making the casting in a single piece." The other large image of Dai Butsu at Kamakura, near Yokohama, is somewhat smaller than this, and dates from a period three centuries more recent. The various temple bells, some of which are of great size, are remarkable for the sweetness and mellowness of their tones, which contrast greatly with the harsh, clanging sounds to which we are accustomed in Europe. They are struck on the outside by huge pine beams which are suspended by strong ropes. The vessels ordinarily used in worship, such as vases, lamps, and incense-burners, are also of bronze, many of them being fine specimens of art, executed in high relief, and finished with much care. The demand for art metal work of a high order has thus existed for centuries in Japan; and so far as can be judged from the specimens of more modern work of this description, the hand of the Japanese workman has not lost its cunning. In the Japanese Art-Gallery in Grafton Street, among many rare and beautiful productions of the Land of the Rising Sun, the metal work well deserves attention. A pair of dark green-tinted bronze vases, fourteen inches high, inlaid with gold, are conspicuous for beauty of design and workmanship. They are said to have occupied the maker seven years, and their curious tint is said to be a trade secret. It must be understood that it is no mere surface colouring, but is produced by the mixture of the metals in certain proportions. The work on the rims and necks represent in gold inlay a cloud dragon, while the bodies are decorated with four medallions formed of gold and silver inlays, the shading obtained by an inlay of gold upon silver being very remarkable. The tints of bronzes vary in colour and depth from yellow, green, and ruddy to dark brown, and next to beauty of design, the tint is a *sine quâ non*. A favourite design on bronzes is the dragon, a subject which is treated with much force and character.

A plaque of *Shakudo*—an alloy of gold and copper, and black in colour—set in a bronze mounting, representing the bamboo, is remarkable as showing the care and labour expended by the Japanese artist in working out details. The design represents a meeting between the twelve chief disciples of Buddha; the inlaying of the figures, trees, flowers, &c., is of gold and silver, with various tinted compositions, and stands out from the dark background of the alloy with much brilliancy. One of the compositions employed for shading is called *shibu-ichi*, and consists of three parts of copper to one of silver. Both these alloys are favourite compositions of the Japanese artist. The minute interlaying of gold and silver in another plaque, about eighteen inches in diameter, with a curvilinear border, exhibits marvellous skill. The body of the plaque is of iron, and the border is adorned with grape-leaf and fruit patterns, the former being of gold, the latter of silver. This is the work of Komai, of Kioto, whose family held the office of sword-mounters to the Court. Swords in the olden time

were much prized by their owners, for the quality and temper of the steel, and much cost was lavished on the ornaments of the handles and sheaths. The making of a good sword was regarded as a very serious task, and the maker had to conform to certain rules of conduct from the commencement to the end of the operation. The external ornaments offered endless scope to the skill and care of the worker in metals. Great importance is attached to the maker's name, which is engraved above the guard. It was a common saying of the Japanese, that the swords of celebrated makers, such as Naminohira Yukiyasu, Masamune, and others, could not return to their scabbards, unless they had been dipped in blood; the sword maker's occupation is now gone, not so their fellow-artists, the sword-mounters. Their skill in working metals can always be turned to good account.

Many other works in metal in the gallery deserve mention, but we cannot refer to them here. They all exhibit the patience, skill, imagination, and love of his craft which distinguished the Japanese artist of old. It is to be feared that he is now abandoning these qualities, and seeking a more rapid road to fortune by shoddy foreign imitations, and that beautiful works requiring the patience and loving care of years—such, for instance, as the small cabinet shown in Grafton Street, which was made for the third Shôgun of the last dynasty, and which is probably the finest work of its kind in existence—will soon be things of the past.

ELECTRICITY AT THE CRYSTAL PALACE

III. *Land Telegraphy.*

HAVING regard to the leading part played by our country in the rise and development of the telegraph, it was only to be expected that the display of historical apparatus at the Crystal Palace should be a very good one. Thanks to the antiquarian zeal of Mr. W. H. Preece, F.R.S., and his active interest in all that pertains to the history of his profession, the Post Office has become the careful custodian of all the early telegraphs employed in England, and the stall of H.M. Postmaster General is rich in these relics of the past. Indeed, there is the nucleus here of an interesting museum of telegraphic apparatus; and it is to be hoped that such a museum will one day be established. The Society of Telegraph Engineers and Electricians have now their Ronald's Library of Electrical Works, which is practically open to all inquirers. A public museum of electrical appliances, rendered historical by the lapse of time, would be a supplementary institution of inestimable value.

One of the most interesting of these relics is the 1816 telegraph of Sir Francis Ronald himself, kindly lent by Mr. Latimer Clark, together with a portion of the copper conductor which Ronald threaded through a glass tube, protected by a wooden trough, and buried in his garden at Hammersmith. It was a frictional electric telegraph, and indicated letters by the divergence of two pith balls, after a plan somewhat similar to the suggestion of "C.M." in the *Scots Magazine* for 1759. This device is fully described in Ronald's "Electrical Telegraph," 1836, the first work published in England on the subject. A copy of this work is possessed by Mr. Latimer Clark, who we may also mention has lately acquired a forgotten book on the history of telegraphs (non-electrical), published in 1797 for the author, Mr. J. Gamble.

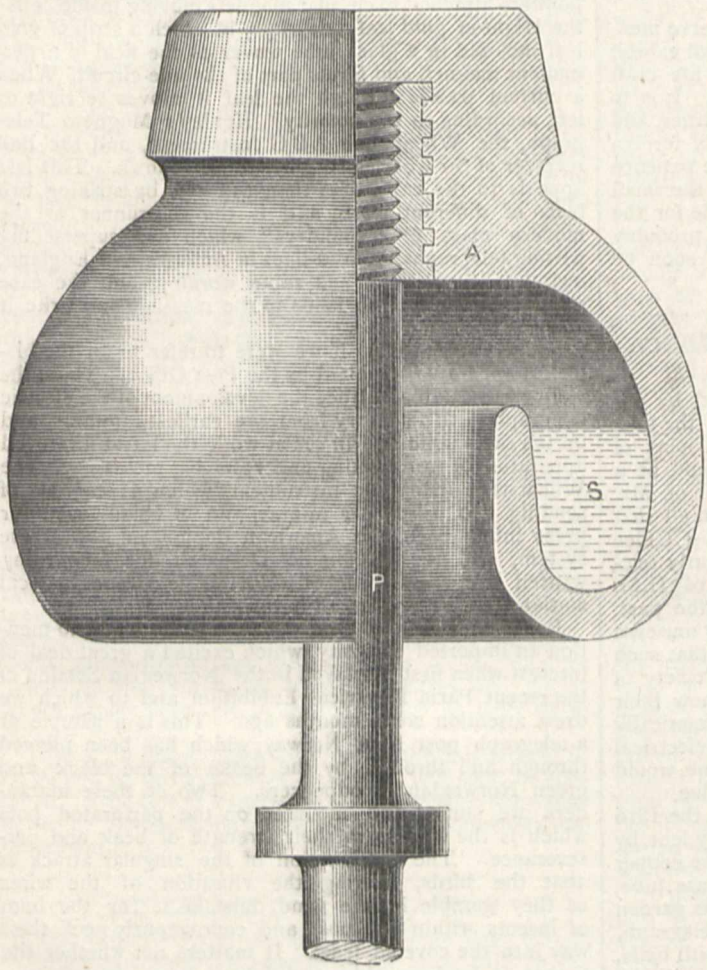
On August 5, 1816, the British Admiralty expressed their opinion to Sir Francis Ronalds that "telegraphs of any kind were then wholly unnecessary," and the invention of Ronalds was neglected. Nevertheless, being worked by static electricity, it is doubtful if it ever would have become a practical success. The "fossil" telegraph of Messrs. Cooke and Wheatstone, laid between Euston and Camden Town in 1837, was the first practical telegraph in operation, and a specimen of it is shown by the Post Office. The line was formed of copper wires covered with cotton and pitch, and inlaid in triangular lengths of wood, which were buried underground. It was worked in connection with Cooke and Wheatstone's Five Needle Telegraph, the parent of the present single and double needle instruments, now used in railway signalling.

Especially interesting also are the porcelain tubes employed by Samuel Morse as insulators, and the lead type, cast by that inventor as early as December, 1832, for his electromagnetic telegraph, now known as the Morse inker. The original Cooke and Wheatstone needle instruments, and the apparatus designed to compete with them, for example, Alexander Bain's I. and V. telegraph, in which the alphabet is formed by the movement of two pointers attached to circular magnets moving inside coils; the Highton gold leaf telegraph, in which a strip of gold leaf inclosed in a glass tube traverses the field of a permanent magnet, and forms part of the line-circuit. When a current passes through the leaf it moves to right or left, according to the polarity. Henley's Magneto Telegraph, the Wheatstone A B C instrument, and the Bell receiver of Sir Charles Bright, are also shown. This last appeals to the ear rather than the eye, by striking two bells of different pitch, and is the forerunner of the modern class of "sounders" which are superseding writing telegraphs on land-lines in America and England, owing to their clean and rapid working, and the ease with which a clerk can listen to the message and write it down at the same time.

Space would fail us if we were to refer to all the historical apparatus exhibited by the Post Office. There the visitor will be able to trace the development of the electric telegraph in this country from the earliest attempts, and on the same table he will see at work the latest improved apparatus for transmitting and receiving messages. The Wheatstone automatic instrument, which is capable of sending 200 words per minute, and is chiefly used for press intelligence, the American duplex, on the Morse system, and the Pneumatic Despatch, for forwarding written telegrams from St. Martins le Grand to local stations in the City, are all in operation.

Before leaving the Post Office stall we ought to mention an imported curiosity, which excited a great deal of interest when first displayed in the Norwegian Section of the recent Paris Electrical Exhibition, and to which we drew attention some months ago. This is a sample of a telegraph post from Norway, which has been pierced through and through by the beaks of the black and green Norwegian woodpeckers. Two of these marauders are stuffed and mounted on the perforated pole which is the witness to their strength of beak and perseverance. The explanation of the singular attack is that the birds, hearing the vibration of the wires as they tremble in the wind, mistake it for the hum of insects within the post, and courageously peck their way into the coveted feast. It matters not whether the timber is fresh or old; and I have been assured by a Norwegian telegraph engineer, that he has found several newly erected posts perforated in a single night. Bears in the mountain districts are also said to attack the foot of the posts, tooth and nail, under the impression that there are bees within; and after the experiments of Mr. C. V. Boys on the influence of tuning forks on spiders (see NATURE, vol. xxiii. p. 149), the deception of these animals is quite intelligible. The authenticated fact that wolves are scared away from whole districts in Norway on the appearance of a telegraph line there, is not so easily understood, unless it be that the wires are held to be some kind of snare. This explanation is supported by the custom of Norwegian farmers of running a cord on poles round their homesteads to keep off the wolves, and it is stated that an entire peninsula was kept clear of wolves by spanning its neck in this fashion.

The War Office exhibit, which, in the face of flattering expectations, and in spite of interested accounts, must be pronounced a very disappointing one, and comparatively insignificant when contrasted with the display made by foreign governments in Paris, has nevertheless a novel feature in the equipment of a mountain telegraph train for service in the field. This is carried by three dummy mules, one of which bears two drums containing about three miles of insulated wire for laying on the ground, another bears the working tools, and a third the shelter-tent, furniture, and apparatus, constituting the mountain of fire. "Sounders" are used in preference to "inkers" as receiving instruments, and telephones are added, because when a wire is cut by the enemy, or otherwise



Johnson and Phillips' Insulator.

damaged, the telephone will often read a message when no other instruments will. Experiments at Aldershot, and recent experiences in Caffraria, have proved that a telephonic message can be received, though the wire is cut and lying on the ground. As an aid to military telegraphy in a difficult country possessing a brilliant sun, the War Office also exhibit a Mance heliograph, or adjustible mirror, for flashing a beam of light in signals, according to the Morse telegraphic code. The great advantage of this apparatus is that there is no wire which can be cut by the enemy, and little or no delay in erecting a sending-station. In the recent campaigns of Afghanistan and Zululand it has proved of great service to the army, and messages have been flashed over distances varying from forty to sixty miles.

Railway signalling from its earliest infancy is admirably illustrated by the stall of the South-Eastern Railway Company, whose engineer, Mr. C. V. Walker, F.R.S., was one of the first to see the importance of the telegraph for the prevention of accidents and the furtherance of traffic. Mr. Walker's original electromagnetic semaphore, now used in block signalling, his plan for intercommunication between passengers and guards, and his train-describer for announcing to the next station the character of the approaching train, are all worthy of close attention. Mr. Spagnoletti's apparatus, as used on the Great Western Railway, including his indicator for showing if a lamp is "in" or "out," is also very interesting. So, too, is the new system of Messrs. E. K. Winter and Craik, for working single lines on the block system, and now employed with great success in India. By this arrangement, a train leaving station A for station B itself puts the outdoor signal at A to danger, and this signal remains unalterable by either signalman of himself, until the arrival of the train has been signalled from B to A, and "line clear" has again been asked for and obtained. Models of the Preece system, as worked on the London and South-Western Railway, the Sykes' combined lock and block system, as used on the Metropolitan District, and other railways, and Harper's interlocking instruments, as employed by the London, Brighton, and South Coast, and other Railways, are also exhibited. This company likewise shows the Saxby and Farmer Union of Lock and Block Signalling, and many other things, including Perry and Houghton's alarm for tunnels, together with alarm-bells for gate-houses or level crossings. The electric fog and night signal of Mr. E. A. Sullivan is worthy of note. By this the wheel-tire of a passing train is made to press down a lever and sound a gong, but the gong can only be sounded when the signalman liberates the lever by electromagnetism. In King's Electric Railway Signal (exhibited by the Electric Railway Signalling Company of Stone Cross, Notts), there are signal posts placed at intervals along the line, and the train passing the first of these puts the signal, by mechanical means, at danger, while at the same time it signals forward by means of electricity to any distant junction. On passing the next post, it puts the signal at danger, and sets the post just past at line clear. At junctions the signals are connected with the points, which, when opened, show danger to the driver coming on the main line, and clear to the branch, remaining so until the points are closed.

The English firm of Siemens Brothers, Charlton, exhibit a number of portable field outpost telegraphs, with sounders and inkers, such as are used in the German army. Jointers' tools, A B C instruments, and other ordinary telegraphic apparatus, is also displayed, including specimens of their compound telegraph wire, made by covering steel wire with a skin of copper, to increase the electric conductivity and non-rusting qualities. Siemens' telegraph poles made of wrought-iron tubes inserted into cast-iron tubular bases, are also exhibited, together with Le Grand and Sutcliffe's base pile for sinking into the ground, to form a root for the pole. The great weight of this pole is, however, against it, for use abroad, where, owing to the ravages of the white ant, iron poles are preferable to wooden ones. Weight is an important item when transport has to be considered in a new country, and hence the lighter pole of Mr. J. Muirhead (as exhibited by Messrs. Latimer, Clark, Muirhead, and Co.) has advantages in this respect. It consists of a light iron tube, strengthened below by a steel lining, and inserted

in a cast-iron socket, which is flanged vertically to give great strength combined with lightness. The cast-iron socket has a small, flat base plate, which enters the ground, but the lateral resistance of the pole is chiefly due to the radial position of the vertical flanges, which press upon an ever-increasing section of the surrounding soil. Messrs. Latimer, Clark, Muirhead, and Co. exhibit a great variety of telegraphic apparatus, part made by themselves, and part by the Western Electric Manufacturing Company of Chicago. Certain of the American sounders are models of neat workmanship and compact device. While upon the subject of sounders, which are the most promising of telegraphic receivers at present, we may mention the bell-sounder of Sir Charles Bright, exhibited on the stall of Mr. E. B. Bright, C.E. The hammer of this ingenious little instrument strikes upon two musical brass tubes of different pitch, and so gives out a much pleasanter sound than the tapping of the ordinary sounder.

The number of wire and cable manufacturers who exhibit at the Crystal Palace is considerable, and there are signs of great activity in this department, especially for telephonic and electric lighting purposes. We have only to deal with land lines at present, and may mention the excellent specimen of galvanised iron telegraph wire exhibited by Messrs. Johnson and nephew, and Mr. Walter T. Glover, of Manchester, and others. The chief novelty in land wires is the use of phosphor bronze for telephonic lines. This alloy is very strong and conductive, so that much smaller wires are required than when iron is used. Moreover, it withstands the chemical action of atmosphere better, and is less exposed to storms. Its use, however, has not become at all general; and this is partly due to its great elasticity, rendering it difficult to put up. Specimens of this wire are shown by the Phosphor Bronze Company, of Sumner Street, London.

In insulators the pattern exhibited by Messrs. Johnson and Phillips is deserving of notice. As illustrated in the figure, it consists of a porcelain bell A, curved inwards to form an oil-well S, which is filled with a fluid insulator, such as paraffin. P is the bolt of the insulator, which supports it from the bracket of the pole. As a film of dew or rain cannot form on the surface of the insulating oil, the insulation resistance of this insulator is said to be many hundred times higher than that given by the ordinary insulators in use, and what is perhaps of more consequence, it is far more constant.

The tendency of the time is for overhead telegraph wires to give place to underground ones, as they have in Germany. Underground wires are less subject to accident from violence or storms, and hence are easily maintained in good condition. Trunk subterranean lines are about to be laid in England by the Post Office, and there are signs that the existing telephone lines will ere long have to be superseded by wires laid under the streets. For this purpose the box curb of Mr. W. Reddall, exhibited in the Western Gallery, may be useful. The idea is to make the curb of the pavement in the form of an iron box in proper lengths, and lay the wires in it; the lid being removable at will for inspection. The strong earthenware jointed pipes made by Messrs. Doulton and Co., of Lambeth, for holding subterranean wires, are also worthy of remark.

NOTES

Prof. E. Ray Lankester, F.R.S., has been appointed to the Chair of Natural History in the University of Edinburgh, in succession to the late Sir C. Wyville Thomson.

The Senatus Academicus of Edinburgh University have resolved to offer the honorary degree of Doctor of Laws to Mr. John Simon, F.R.S., late medical adviser to the Privy Council; Dr. Angus Smith, F.R.S.; and Mr. Joseph Anderson, secretary to the Society of Antiquaries, Edinburgh. The degrees will be conferred with the ordinary examination degrees in arts, sciences, and divinity at the graduation ceremonial to be held on April 21.

The President of the Linnean Society, Sir John Lubbock, held a reception at the Society's rooms at Burlington House on Tuesday last. The guests began to arrive at nine o'clock, and were received in the Library by the president and officers. Prominent amongst the objects exhibited was a striking portrait of Mr. Charles Darwin, painted for the Society by Mr. John Collier, and allowed by all to be the best portrait extant of our great naturalist. Carnivorous plants were strongly represented amongst the large contributions of plants from the Royal Gardens, Kew, and the leading nurserymen; in addition there were many fine specimens shown for their ornamental qualities. In the glass cases of the Library there were exhibited manuscripts of Linnæus, and medals struck in his honour; Wedgwood medallions of scientific men (lent by Sir Joseph Hooker); a series of caddis-flies, shown by Mr. R. MacLachlin; dredging apparatus, &c., by Mr. H. C. Sorby; new drugs by Mr. Thomas Christy; and Sikkim Rhododendrons, by Mr. J. H. Mangles. In the galleries was placed a series of cases of crustacea and insects, exhibited by Mr. J. T. Carrington; and in the Council Room a set of drawings of pollen, made by Mr. Charles White. The rooms were well filled during the evening, and among the visitors were many men distinguished in various departments of science.

The following are the lecture arrangements of the Royal Institution after Easter:—Mr. E. B. Tylor, four lectures on the History of Customs and Beliefs, on Tuesdays, April 18 to May 9; Prof. A. Gamgee, four lectures on Digestion, on Tuesdays, May 16 to June 6; Prof. Dewar, eight lectures on the Chemical and Physical Properties of the Metals, on Thursdays, April 20 to June 8; Mr. F. Pollock, four lectures on the History of the Science of Politics, on Saturdays, April 22 to May 13; and Prof. D. Masson, on Poetry and its Literary Forms, on Saturdays, May 30 to June 10. The Friday evening meetings will be resumed on April 21, when Prof. Dewar will give a discourse on the Experimental Researches of Henri Ste Claire Deville.

The following are among the papers announced to be read at the meeting of the Institution of Naval Architects to-day and to-morrow:—The revision of the tonnage laws, by W. H. White; on tonnage measurement and moulded depth in relation to freeboard, by W. W. Rundell; on the basis for fixing suitable load lines for mercantile steamers and sailing vessels, by B. Martell; on launching velocities, by W. Denny, F.R.S.E.; on the transverse strains of iron merchant vessels, by Messrs. P. Jenkins and T. C. Read; on progressive speed trials, by J. H. Biles; on curves of stability of some mail steamers, by J. H. Biles; approximate formulæ for the calculation of trim, by M. J. A. Normand; on the reduction of transverse and longitudinal metacentric curves to ratio curves, by W. Denny, F.R.S.E.

On Tuesday evening, at the Royal College of Physicians, a large representative meeting of both branches of the medical profession was held, with a view, in face of organised opposition to the progress of scientific research, of taking steps to "bring the legitimate influence of the medical profession more effectively to bear on the promotion of those exact researches in physiology, pathology, and therapeutics which are essential to sound progress in the healing art." Sir William Jenner presided. The chairman pointed to the fact that at the present time there was no society to guide and protect research, and stated that it was intended to found the proposed society on a broad basis. He declared that it was not proposed to attempt to abrogate the existing law on research; but it was intended to watch the operation of the law, and to see that there were no delays in important cases. He referred, as an instance of the

dangerous delays which occurred in granting licenses to the late poisoning case tried at the Old Bailey. The society proposed to be formed could, on the one hand, will bring its influence to bear to restrain those ardent pursuers of science who did not regard the susceptibilities of the public, and, on the other, it could enlighten the public, and so lessen the morbid sensibilities which had been aroused. He then proposed that the society should be formed; the motion was supported by the Master of the Rolls, who wished "God speed" to those engaged in research for the alleviation of human suffering. The motion was carried *nem. con.* The president of the Royal Society, Mr. Spottiswoode, seconded by Dr. Quain, proposed that the association should be formed of representative members of the profession and others, and this was carried. Sir James Paget, Sir William Gull, Sir Risdon Bennett, Sir J. Lubbock, and others proposed and supported resolutions on matters of detail.

IT is probable that the Observatory of Popular Astronomy established by a decree of M. Paul Bert in the Trocadero Palace, Paris, will be transferred into a general institute for popular education. The appointments gazetted by M. Paul Bert on the very day on which he left the Ministry will be declared void, and other appointments are to take place to meet the requirements of the enlarged institution. Since he resigned his seat in the Cabinet, M. Barthelemy St. Hilaire has resumed his great work of translating Aristotle. Up to the time of his appointment twenty-four volumes had been published by him. The matter in hand will fill not less than twenty-six volumes, and is mostly confined to the natural history. Two volumes on the Habits of Animals will be published before the end of the year, and the others are to follow in quick succession. The last volumes will be devoted to Problemata and Fragmenta. A copious index will be the crowning part of this magnificent publication.

AT the meeting of the Royal Dublin Society, held on the 20th inst., Prof. Hull, F.R.S., laid before the "Natural Science Section" a series of 28 maps of the British Isles and the adjoining parts of the European continent, to which he has given the name of Palæo-geological and Geographical Maps. With the exception of the last three of the series, the maps are in duplicate. On one is represented by colour the position of each geological formation (or group of formations), and by a lighter shade of the same colour is shown the area under which this formation is considered to extend beneath more recent strata. On the corresponding duplicate an attempt is made to restore the "palæo-geography" of the period represented by the formation in question—the land being represented by shades of brown, the sea by those of blue, according to the heights in one case, and the depths in the other. The formations treated in this manner are: 1, the Laurentian; 2, the Cambrian; 3, the Lower Silurian; 4, the Upper Silurian and Devono-Silurian (or Lower Old Red Sandstone); 5, the Devonian; 6, the Old Red Sandstone and Lower Carboniferous; 7, the Upper Carboniferous; 8, the Permian; 9, the Trias; 10, the Lias and Oolite (Jurassic); 11, the Cretaceous; 12, the Tertiary (Eocene and Miocene); 13, the Post-Pliocene or Glacial, in three maps. The above grouping was found to be the most convenient for representation, and the colours used for the formations are those of the Geological Survey. Some very interesting results are brought out respecting the physiography of past geological times, including the probable position of the old continent of Atlantis, which the author considers to have existed in Laurentian, Cambrian, and Lower Silurian epochs. The recent borings for coal, or water, under the Cretaceous and other strata of the south and centre of England, have enabled the author to show with much precision the structure of these districts; and he places a possible coal-basin under the margin of the North Downs and the Wealden area, thus agreeing with the views long since stated by Mr. Godwin-Austen.

VIENNA is to have its Exhibition of Electricity in the coming autumn. A committee has been formed, under the presidency of Count Hans Wilczek. The Board of Trade has offered the committee every support.

COL. BURNABY made a successful balloon trip across the Channel on Thursday last. He was alone, and had a large load of ballast, by judicious expenditure of which he was able to avail himself of favourable air-currents. He left Dover at 10.35 a.m., and came to ground about eighteen miles beyond Dieppe late in the afternoon. His greatest altitude seems to have been 11,000 feet.

A RECENT number of the *Celestial Empire*, referring to a discovery of some ancient graves near Shanghai, gives an interesting account of Chinese burial in former times. A man of means purchased his coffin when he reached the age of forty. He would then have it painted three times every year with a species of varnish, mixed with pulverised porcelain—a composition which resembled a silicate paint or enamel. The process by which this varnish was made has now been lost to the Chinese. Each coating of this paint was of some thickness, and when dried had a metallic firmness resembling enamel. Frequent coats of this, if the owner lived long, caused the coffin to assume the appearance of a sarcophagus, with a foot or more in thickness of this hard, stone-like shell. After death the veins and the cavities of the stomach were filled with quicksilver for the purpose of preserving the body. A piece of jade would then be placed in each nostril and ear, and in one hand, while a piece of bar silver would be placed in the other hand. The body thus prepared was placed on a layer of mercury within the coffin; the latter was sealed, and the whole then committed to its last resting-place. When some of these sarcophagi were opened after the lapse of centuries, the bodies were found in a wonderful state of preservation; but they crumbled to dust on exposure to the air. The writer well observes that the employment of mercury by the Chinese of past dynasties for the purpose of preserving bodies ought to form an interesting subject for consideration and discussion in connection with the history of embalming and "mummy making."

THE return of works licensed to be printed during the past two years by the Japanese Department of the Interior is of much interest as showing the tendency of the minds of educated people of the country. The figures show that considerable mental activity exists in the country. Last year 545 works on political subjects were issued, against 281 the previous year. Law was represented by 255 works against 207 in 1880; while in political economy the numbers were 25 and 15 respectively. Geographical works declined from 170 in 1880 to 164 in 1881; while in medicine the increase was from 229 to 267. In scientific subjects we find 25 works on chemistry, and 22 on natural history in 1880, reduced 17 and 20 respectively in 1881. Natural philosophy also shows a decline from 19 to 13; so do mathematics from 116 to 107. Similarly works on astronomy have declined from 9 in 1880 to 7 in 1881. In other classes of books, however, we find a great increase. Ethical and moral works have increased from 32 to 93; historical works from 196 to 276; books on poetry and poetical works from 491 to 556; books on drawing and writing from 127 to 339. Engineering works have increased from 8 to 28; and books on commerce from 70 to 113. School-books again this year are nearly half as numerous as all other books put together, numbering 704 against 707 last year. Lighter literature is by no means neglected, for 193 volumes of tales, novels, &c., were published during 1881. During the year 149 new newspapers started, but the large proportion of 114 never saw the commencement of the present year. In 1880 the publication of 266 new journals commenced, 47 of which soon succumbed. The operation of the press laws cannot be very stringent, when we find that during two years, of 415 newspapers,

161 of which ceased, only one was prohibited by the Government. In addition to those above-mentioned, we find in the list works on etiquette, accounts, naval and military works, dictionaries, encyclopædias, &c. The total number of works published during the year was 4910 against 3792 last year. Very many of these books are translations or adaptations of European or American works. Among such books recently "conveyed" we find Smiles's "Character," Roscoe's "Chemistry," Leone Levi's "International Commercial Law," Bouvier's "Law Dictionary," Palgrave's "Chairman's Handbook," Lord Chesterfield's "Letters," "Every Man his own Lawyer," Taylor's "Medical Jurisprudence," Thompson's "Social Science and National Economy," Baxter's "London Statistics," "The Science of Familiar Things," Mill's "Three Essays on Religion," Draper's "Conflict of Religion and Science," portions of Buckle's "History of Civilisation," Thompson's "Outline of the Necessary Laws of Thought," &c. As to the price of these works, we may instance Smiles's "Character," the translation of which by Nakamura, a well-known English scholar, in two volumes, costs only 50 *sen*, or about a shilling at the present rate of the paper currency. The figures and facts here recorded show at least that the path of western progress which the Government is pursuing, is one in which the people desire to take a part.

WE have received from the President of the University of Tokio a copy of the calendar of that Institution for the past year. It is printed in Japanese and English, and thus appears somewhat more bulky than its actual contents would warrant. In the preface, a brief account is given of the growth of this large and apparently flourishing establishment from its first small commencement as a bureau for translating foreign books. We have heard so much recently of the changes in the *personnel* of the Japanese educational institutions from foreign to native teachers, that we turn with some interest to the list of professors. In the department of law we find one foreign and eight native teachers (including in this term professors, lecturers, instructors, &c.). This subject is exceptional, as there are five professors of Japanese law. In science, of the twenty-six teachers, eighteen are natives, and we believe this number has increased recently; and in literature three of the fourteen teachers are foreigners. Judging simply by the degrees which they have obtained in western universities, most of the Japanese gentlemen seem well qualified for their work. This great and rapid displacement of foreign instructors is certainly a delicate experiment, and we can only hope that it may be successful. *Chi va piano va sano* is a motto which may be commended to Japanese attention in this respect as in many others. The students can hardly complain of excessive charges. The tuition fee for each term (of which there are three in the year) is only four *yen*, nominally 16*s*., but at the present rate of the currency rather less than 9*s*.; while the cost for a term of living, fire, light, &c., is only fourteen *yen*, or about 32*s*. The total number of students attending the college is 205. The examination papers, which are given in full, seem to be quite up to the standard for similar examinations in this country. We are glad to observe that Japanese literature and history are not neglected in the study of more western subjects. A large number of teachers have been provided for these subjects.

PROF. CIVIALE is preparing a large photographic work on the Alps. For ten years, from 1859 to 1868, the author travelled in the Alps with his camera, constantly taking panoramic and smaller (detailed) views. The latter, some 600 in number, principally show the glaciers with their crevasses, moraines, and the rocks forming their banks, the mountains, valleys, glens, natural geological sections, the rocky eminences groved, polished, or ground by former glaciers, and the course of various rivers. The panoramic views, forty-one in number, are taken from the summits, and comprise all the large Alpine chains. Each consists of a number of plates, and twenty include the whole circle of view. These valuable plates are accompanied by two maps in 1 : 600,000, one is specially orographical, the other shows the curves of the panoramic views. Thirteen years were necessary to put the material collected into proper order, to replace the photographic plates by printed ones, to draw and engrave the maps, and to write the text.

THE recent remarkably low level of nearly all the Swiss lakes has encouraged the scientific circles of Switzerland to make fresh researches with regard to pile-dwellings. The societies of the Canton of Thurgau have investigated the Untersee (the lower part of the Lake of Constance), near Steckborn, in the vicinity of the former monastery of Feldkirch. The Untersee was surrounded by a complete circle of pile-dwellings, and the present investigations have yielded valuable results, in the shape of a long list of the most varied objects which have been brought to light.

THE Russian Society of Painters has started a new publication, which will be of interest, not only for lovers of the Fine Arts, but also for science. It is a periodical, "Art in Central Asia," being a collection of well printed drawings of Central Asian architectural ornaments, carpets, paintings, and so on, published under the supervision of M. Simakoff and of the above-named society.

WE learn with pleasure that a special "Geological Committee" has been instituted in Russia, at the Department of Mines, for a systematic geological exploration of Russia, and for the preparation of a detailed geological map of the country. The Government has allowed an annual grant of 3000*l*. for the expenses of the Committee and for its publications.

DR. RAE points out that, according to the Royal Geographical Society's *Journal*, the late Pundit Nain Singh was awarded not the Royal Medal, but a gold watch.

WE have been requested to state that the late Dr. T. Romney Robinson was born in the year 1792, and not in 1793, as stated erroneously in the obituary notice which recently appeared in our columns.

THE additions to the Zoological Society's Gardens during the past week include two Bonnet Monkeys (*Macacus radiatus* ♀ ♀) from India, presented respectively by Mr. Henry Worth and Mrs. Nicholson; three Herring Gulls (*Larus argentatus*), British, presented by Mr. Rowland Ward; a Herring Gull (*Larus argentatus*), British, presented by the Chevalier Da Costa Ricci; a Sclater's Curassow (*Crax sclateri* ♂), a King Vulture (*Gypagus papa*) from the Province of Alagoas, Brazil, presented by Mr. Frederick Youle; a Puffin (*Fratercula arctica*), British, presented by Mr. H. M. Upcher; two Grey Ichneumons (*Herpestes griseus* ♂ ♀) from India, two Tayras (*Galictis barbara*) from Brazil, a Wild Boar (*Sus scrofa*), European, deposited.

OUR ASTRONOMICAL COLUMN

THE GREAT COMET OF 1881.—In the *Monthly Notices* of the Royal Astronomical Society for January there are published two letters addressed to the secretaries by Dr. W. Bone of Castlemaine, Victoria, referring to an object seen near the great comet of last year, on the evening of June 10. In a telegram which he sent to the Melbourne Observatory the same night, he described it as discoid and like a circular comet, and states it had travelled south 6′ in thirty-four minutes; its place at 6h. 45m. in R.A. 5h. 18m 30s., Decl. −14° 24′. He asked that search might be made at Melbourne, but mentions that his telegram was not answered. In his first letter he writes: "On June 10, 1881, whilst measuring the position of the comet, then visible here at 5h. 52m. mean time of place, I noticed a peculiar discordance in each succeeding measure, and at length found that the star (?) from which I was measuring was a rapidly-moving body." He found it "somewhat discoid, but its light, although bright, was

diffused and hazy," and adds that it had moved through six minutes of arc in a *northerly* direction, contrary to what was stated in his telegram. The approximate place for 5h. 52m. mean time (as we take it) was in R.A. 5h. 18m. 8s., Decl. −14° 18′, showing that a southerly motion was intended. In his second letter Dr. Bone says: "I should place the magnitude at about 2·5, for it was visible to the naked eye in first twilight;" though the telegram has what in this case was somewhat unnecessary information: "No asteroid in that place."

An observation of this kind would hardly perhaps have required strict examination, were it not that about thirty-eight hours later Dr. B. A. Gould, at Cordoba, compared the comet with an object which he could not afterwards identify, and after much hesitation, through fearing some great error, he communicated the particulars to the *Astronomische Nachrichten*, No. 2384. We have already referred to these observations in this column (NATURE, vol. xxiv. p. 342). At 10h. 58m. 9s. sidereal time, on June 11, Dr. Gould made a rough preliminary determination of the comet's place, for the purpose of finding a comparison-star, when he says he found one in the field; with this star he compared the comet four times, the results being:—

Cordoba Sidereal Time.	Comet followed.	Comet South.
h. m. s.	s.	′ ″
11 8 49	49	5 12·9
— 11 2·5	49	5 8·3
— 13 11·0	48	5 8·5
— 14 37·5	48·5	5 2·8

The rough place of the comet by the circles of the equatorial, agrees sufficiently well with that we now know it must have occupied at the time, but if the comet had been observed during the micrometrical comparisons, the position of the supposed star would have been 5h. 10m. 23s., Decl. −9° 29′·8, where no star has been catalogued, though Dr. Gould thought it would hardly be below the third magnitude, and he could rather believe it as bright as the second.

In *The Observatory* for January, Mr. Christie has printed a letter from the able amateur, Mr. John Tebbutt, of Windsor, New South Wales, suggesting an explanation of Dr. Gould's observation which merits attention. He made four circle-comparisons of the comet with Rigel on the morning of June 12, the last of which was only 1h. 29m. of absolute time previous to the first observation at Cordoba, and he states "there was then, I am confident, no object near the comet answering to the description already given." Were it not that the Cordoba instrumental place agreed closely with the actual position of the comet, he adds, he would be disposed to suggest that Dr. Gould had not observed the comet with the micrometer at all, but possibly the two stars, B.A.C. 1592 and 1597, "whose relative magnitudes and position agree almost exactly with his observations, and whose differential declination would gradually diminish from the effect of refraction as the stars approached the horizon."

We will now examine the case with some strictness. The following positions of the comet are calculated from the elements published by Mr. White, of the Melbourne Observatory, and will be very nearly correct for the dates in question:—

G.M.T.	True R.A.	True N.P.D.	Log. distance from the Earth.
	h. m. s.	° ′ ″	
June 9·5 ...	5 9 23·9	... 104 57 5	... 9·59144
10·0 ...	5 9 50·5	... 103 39 30	... 9·58131
10·5 ...	5 10 18·2	... 102 17 33	... 9·57121
11·0 ...	5 10 46·9	... 100 51 6	... 9·56116
11·5 ...	5 11 16·8	... 99 19 59	... 9·55121
12·0 ...	5 11 48·2	... 97 44 2	... 9·54139

From the ephemeris, it follows that the comet's motion between Dr. Gould's first and last comparison was +0s.·41 in R.A., and +44″·7 in declination. The observed difference in declination was only 10″·1. If Dr. Gould had observed the comet the difference of refractions of comet and star would have been about 0·28s. and 2″·6 at the first comparison, and 0·47s. and 4″·3 at the last, so that the discordance between observed and computed motion would not be explained by the refraction.

The stars referred to by Mr. Tebbutt are Bradley 718, and 69 λ Eridani, and both are found in Mr. Stone's recently published catalogue. Their apparent places on June 11 were:—

	R.A.	Decl.
	h. m. s.	° ′ ″
Br. 718	5 2 39·06 ...	−8 49 14·6
λ Eridani ...	5 3 27·90 ...	−8 54 27·8

If now, Dr. Gould, in "the exceptionally thick haze and mists of the horizon," and bright twilight which he mentions, mistook λ Eridani for the comet, and compared with Bradley 718, we have the following striking agreement:—

	In R.A.	In Decl.
	s.	′ ″
Differences of above places	+48·8 ...	−5 13·2
By Gould's comparisons	+48·6 ...	−5 8·1

Difference of refractions at first comparison, 0·7s. and 6″·5, and at the last comparison, 1·7s. and 15″·7, so that the ten seconds' change in the difference of declination measured with the micrometer is accounted for by refraction, and there is a tendency to diminishing difference of R.A. in the comparisons, which refraction would necessitate. Dr. Gould states, that these comparisons were all he could obtain "before the comet passed below the horizon," and the true altitude of λ Eridani at the last of them was 2° 17′: the altitude of the comet at the same time being 4° 15′.

Mr. Tebbutt thinks, if his suggested explanation be accepted, it will be necessary to admit "a temporary outburst in the light" of B.A.C. 1592 (Bradley 718), and it happens that there is some reason for believing that star to be variable. It is a wide double star, No. 649 of the Dorpat catalogue. Sir John Herschel, in one of his sweeps at the Cape of Good Hope, on December 26, 1836, estimated the principal component 7·8 (the companion is about 10m.): it was rated 6·0 by Struve, 6·8 by Jacob in 1849, and 6 or 7 by Lalande, Bessel, Knorre (in his Berlin chart), Santini, and others, but in Mr. Stone's new catalogue it is called 5m., or only one magnitude less than λ Eridani, which has been pretty consistently estimated a fourth.

It appears, then, that Mr. Tebbutt's explanation of the difficulty in Dr. Gould's case, is a very probable one: the instrumental comparison preceded the first micrometrical observation about ten minutes, and the assumption of course will be, that after applying the micrometer, the telescope, instead of being pointed to the comet, was turned upon the stars alluded to above, which, in the dense haze, were blurred and confused.

With respect to the observations at Castlemaine, Victoria, on June 10, it is to be regretted that Dr. Bone has not communicated the comparisons of the comet with star as entered in his note-book, and his letters having been given publicity in the official periodical of the Royal Astronomical Society, it is desirable that these should be forwarded, that the true explanation may be found. His geographical position is given in a note on the last Transit of Mercury, which appears in the same number of the *Monthly Notices*: longitude 9h. 36m. 55s. E., latitude 37° 4′ 11″ S.; that phenomenon was observed with a 4·7 inch (Wray) equatoreal, which it may be presumed was the instrument used for observing the comet. It so happens that observations were made the same evening at the Melbourne Observatory, and the earlier comparisons at the same time that Dr. Bone was similarly employed at Castlemaine, which is only 3 min. west of Melbourne. The Melbourne reference star was at first 8 Leporis, the apparent place of which was in R.A. 5h. 8m. 4·2s., Decl. −14° 2′ 25″, therefore in the same R.A., and only 15′ north of the position which Dr. Bone assigns to the moving object at 5h. 52m. M.T. It is difficult to explain how such an object could have escaped the attention of the Melbourne observers, while they were comparing the comet with a star so close to its place. The position of the real comet may be interpolated from the above ephemeris, or it may be inferred from the Melbourne observations the same evening. The second series of comparisons were made with a star which we find to be No. 173, Hour V. of Weisse's Bessel, and reducing this series we have for the comet's place:—

Melbourne M.T.	App. R.A.	App. Decl.
h. m. s.	h. m. s.	° ′ ″
June 10 at 6 3 13·6 ...	5 9 40·83 ...	−14 3 22·1

Comparing this with the result of the earlier measures from 8 Leporis (*Monthly Notices*, vol. xli. p. 432), we have the following positions of the comet for Dr. Bone's times:—

	R.A.	Decl.
h. m.	h. m. s.	° ′ ″
At 5 52	5 9 40·5	−14 4 15
6 45	5 9 42·7	−13 58 32

At 5h. 52m. its true altitude was 8° 54′, but it set at 6h. 41m., four minutes before the last observation at Castlemaine. With Dr. Bone's place for his object it would be 1° above the horizon at this observation. Refraction would of course have been exercising a great effect upon any comparisons made near so

small an altitude. In the absence of the original observations, we can only conjecture that the supposed moving object or second comet, was none other than the Melbourne comparison star 8 Leporis (commonly estimated 6m.), and it may have been under this impression that Mr. Ellery did not think it necessary to reply to the telegram sent to him from Castlemaine. The motto of the Royal Astronomical Society, "*Quicquid nitet notandum*," upon the principle of which Dr. Bone says he acted in putting his observation upon record, is a good one no doubt, but where there is suspicion of error it is desirable to be in possession of all particulars, and in this view we would suggest the early publication of his comparisons as they were actually made.

A NEW COMET.—A comet discovered in America, apparently on March 18, is likely to become a conspicuous object before perihelion, which, according to the first rough orbits, does not take place until June.

MEDICAL ELECTRICITY

A PAPER "On Measurement in the Medical Application of Electricity," was read before the Society of Telegraph Engineers, by Dr. W. H. Stone and Dr. Walter Kilner, on March 9. Dr. Stone commenced by stating that the subject had been suggested by Lieutenant-Colonel Webber, the chairman, and that the details the authors proposed to give that evening were mainly preliminary to fuller treatment, which they hoped to offer at some future period.

Medical electricity, he said, had been up to now a heterogeneous mixture of loose statements, doubtful diagnosis, and erroneous therapeutics. Glaring instances of these were given. With hysteria, Metallotherapy, and magnetic appliances, they did not propose to deal: science is in far too elementary a state to see through these obscure, though real phenomena. Probably, the key to the great enigma of the connection between electricity and nerve force had yet to be found. The bold statement that "electricity is life" is demonstrably false in many particulars. Speaking generally, medical electricity had suffered from its exclusive handling by physiologists and physicians, who might receive valuable help from physicists; indeed, the writers of the paper were actually soliciting such assistance at the hands of this young and active society. Medicine and its kindred arts lend themselves ill to measurement: the tone of mind required for their practice is rather judicial than computative; it is oftener concerned with weighing evidence, and balancing alternatives, than with solving equations. But men who work by measurement are usually sterling and accurate men; indeed, Prof. Schuster has recently shown how mathematics can help science. Where measurement *can* be used, it *should* be used; and this was their text for the evening.

The speaker then proceeded to divide the forms in which electricity had been used medically into four, namely—(1) continuous currents, (2) continuous currents made to intermit, (3) induced currents, termed generally "Faradisation," (4) statical electricity. The last of these was the first employed, but it had given the least satisfactory results of any. The third method had been far the most deeply studied. Duchenne's great work on Localised Electrisation early drew attention to this department. That genuine and indefatigable observer was able to point out so many definite diagnoses, and to isolate so many new nervous and muscular diseases by means of the induction-coil, that this instrument had been given somewhat excessive prominence as a therapeutic agent. Physiologists had also found in it a convenient stimulant for testing the action of nerves and the irritability of muscle; perhaps also the localisation of brain-functions. Hence muscular contraction and the action of intermittent currents in alternate directions had been too much relied on as evidence of activity. One chief object of the paper was to point out that the future of electro-therapeutics lies more in the continuous current, used either in its first or second form, the latter of which has hitherto received little or no attention. In confirmation of these views, extracts were read from Prof. Erb's valuable memoirs in Ziemssen's Cyclopœdia of Medicine.

Before, however, a single step could be taken in this scientific path, we must have some tolerably accurate mode of measuring the agent we are employing. It is obvious that the units used should be as far as possible those generally adopted in the scientific world.

To begin with resistance: This in the human body is singularly great, and is especially located in the epidermis, which, when dry, is an excellent insulator. Wetting it with sulphate of zinc or common salt diminishes this resistance very materially; though even when care is taken in this respect, the residual opposition to a current is large. From hand to hand it is usually about 6000 ohms. In the larger bulk of the trunk, from the sacrum to the nape of the neck, it never, even after long wetting, sinks much under 1500 ohms. That of the head, from nape to forehead, is about 2000 ohms. In one case it was more precisely 1930 ohms, in an adult, and in another, a child, 2500 ohms. The resistance of different tissues, though not exactly to the present purpose, had been studied by Prof. Eckhard, who stated that muscle was the best conductor, and that this being taken as a unit, cartilage would have a resistance twice, tendons and nerves about 2·1, and bone nineteen times as great. Matteuci states that muscles conduct four times as well as nerves, brain, or spinal chord. The resistance of the skin varies from day to day, being modified by moisture, and by the fulness of the capillary vessels. In a particular case, the positive pole of a battery was placed on the sacrum of a child, and the other on the leg, over the extensors of the foot. By using the same current, and adding quickly a known resistance, the resistance of the body was at first found to be 11,250 ohms, which, on thoroughly soaking the skin, was reduced 2875 ohms. Three days previously, the resistance before soaking was 13,000 ohms, and after that process sank to 3000 ohms. Personal idiosyncracy exercises an influence, a delicate skin conducting better than one which is coarse. The face and neck offer the least; the soles and palms the greatest resistance. Disease causes variation of conductivity: the skin over affected muscles in lead paralysis has its resistance increased, while in many old cases of hemiplegia it is decreased to a greater or less extent according to the amount of atrophy which has taken place.

The resistance of muscle in disease is sometimes diminished, sometimes augmented. Augmentation takes place, at the commencement of degenerative changes, from the inferior conductive power of fat to that of healthy muscle. In a case of infantile paralysis, the sound leg had a resistance of 2500 ohms, the affected leg of 3250 ohms. In a wasted muscle of many years' standing, the enormous resistance of 16,500 ohms was reached. It was both easy and desirable to multiply facts such as these.

The second preliminary point was the current which could be borne with impunity. Here results were very discordant. In the three fatal cases from touching the conductors of dynamo-machines, at a music-hall, in the Russian Navy, and at Hatfield, the necessary facts for measurement were absent; although Dr. Siemens had stated that he had often taken a current sufficient to produce a powerful light with impunity. In a case now in St. Thomas's Hospital, a current of 50 milliwebers was borne with difficulty, and one of 20 milliwebers with ease and great benefit. A case of diabetes, recorded by Dr. Stone in the *Proceedings* of the British Association at York in 1881, took about 10,000 micro-ampères, or 10 milliwebers, through his head, from nape to forehead, after some practice; using for its production from 15 to 20 cells of a bichromate battery. The particular battery, however, mattered very little; Leclanché's, bichromates and zinc-carbons with sulphate of mercury, all act well, and need not be of large size or small resistance. One was shown, in which test-tubes filled with mercuric sulphate, containing free acid, formed the jars; another in which a rod of zinc of 5·16″ diameter, and a similar sized carbon, such as is used in electric lamps, were immersed in the bichromate solution. Connection was here made with the carbon by a piece of drawn tube sprung on to it, thus doing away with the use of clamps. All these, as well as most of the apparatus shown, were made in Dr. Stone's workshop, chiefly with his own hands.

In consequence of the high resistance of the skin, it was essential to give a large size to the poles employed for applying the current, &c. Amalgamated zinc, with the mixture of potter's clay kneaded with the solution of common salt, used in physiological experiments, laid over it, was perhaps, theoretically, the best; but powdered carbon placed in a bag and immersed in salt and water, answered equally well; or the surgical appliance termed Spongio-piline, a thick felt, backed by india-rubber, through which a well-tinned copper wire was threaded, so as to encompass its whole circumference without anywhere projecting so as to touch the cuticle. The poles could hardly be too large.

A convenient form of Thomson galvanometer with graduated shunts, due to Dr. Kilner, was shown, and also a simple but effective instrument for producing intermissions in the current at any required interval of time. This apparatus consisted of a

metronome with contact-pieces dipping into mercury-cups at each oscillation, a condenser being placed under the instrument to get rid of the extra current, and so to equalise the physiological effect of the making and breaking currents.

The measurement of induced currents presented considerable difficulties. The Conference at Paris had recommended the use of standard induction-coils, but this method does not give any but arbitrary measures. Dr. Stone had tried and showed a vacuum-tube, in which the tension of air could be varied by combining it with a barometric-column and a movable cistern. This gave a ready means of varying the force of the discharge, by using it as a shunt of variable resistance, and had the interesting results of shunting the "make-current" at a definite point, while allowing the "break-current," which is about six times stronger, to pass between the platinum points; thus obtaining an induced current in one direction only. Latterly he had adopted also condensers of definite capacity charged to definite potentials. The writers were, however, still experimenting with another method, depending on Sir W. Thomson's determinations of spark-length. The most practical method, at present, seemed to be to pass a continuous current of measured strength through an automatic commutator, which at alternate oscillations diverted it in one and the other direction. If there was any real physiological value in rapid reversals of direction, as was claimed by some experimenters, it could thus be secured, without the use of an induction coil. Another form of rotating-commutator was also shown, in which an ebonite cylinder, pressed on by six springs, at each quarter-turn connected, first, the condenser to the battery, so as to charge it, and then discharged it through the patient. To obviate the necessity of employing a large battery with the condenser arrangements, Planté's secondary battery could be charged in parallel position from a small number of Grove's cells, and discharged through the condenser in series. In all these contrivances, however, as the current gained in tension, it seemed to lose somewhat in chemical and catalytic power, and to assimilate gradually to the static form.

In the discussion which followed Mr. Preece pointed out that the use of electricity for curative purposes had been advocated as long ago as the year 1759, by John Wesley, and recommended the use of the dynanometer for the measurement of induced currents, as this instrument gave indications in the same direction with all currents. Prof. McLeod, Mr. Fitzgerald, and Prof. Ayrton also made comments on the paper.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—It is proposed to spend 300*l.* extra within the next three years for the following objects at the Botanic Gardens: thinning the belt and groups of trees; raising the level of some unoccupied areas and sowing them with grass; replanting the willow bed and making new beds; and the improvement of the collection of trees, already good, so as to keep up its special reputation.

Prof. Hughes having expressed to the Vice-Chancellor the serious difficulty found in carrying on practical studies in the Woodwardian Museum without additional class-room accommodation, it is arranged that Mr. Keeping, the curator, shall cease to reside in the museum, and be allowed an equivalent sum for house-rent and other advantages attached to the curatorship.

Prof. Humphry proposes to take classes in Surgery during the Long Vacation.

SCIENTIFIC SERIALS

Journal of the Franklin Institute, January.—A new odontograph, by H. Bilgram.—Dimensions and performance of the hull and machinery of the U.S. steamer *Dispatch*, by chief-engineer Isherwood.—Mechanical drawing, by C. Sellers, jun.—The application of frictional electricity to the purification of middlings, by R. Grimshaw.—On the constants in Gordon's formula for the strength of columns, by M. Merriman.—Chronological table of American patents, by E. Hiltebrand.

Annalen der Physik und Chemie, No. 2.—On the elliptical polarisation of light in reflection at crystal surfaces, by E. Schenck.—Influence of mechanical hardness on the magnetic properties of steel and iron, by L. M. Cheesman.—On the maximum of magnetisation of diamagnetic and weakly-paramagnetic bodies, by H. W. Eaton.—On the reflection of electric rays; the influence of the cathode's form on the distribution of the phosphorescent light in Geissler-tubes; the connection between density of gas and layer-interval in Geissler-tubes; and the band-spectrum of air, all by E. Goldstein.—On the formation of peroxide of hydrogen during combustion, by A. Schudler.—Reply with regard to the formation-heat of water, by the same.—The expansion of water through absorption of gases, by K. Ångström.—Theory of refraction on a geometrical basis, by A. Kerber.—On the minimum of rotation of the light-ray in combined refraction and reflection at a sphere, by F. Kessler.—The minimum of deflection of a light-ray by a prism, and the minimum of time in refraction of light, by the same.—On electric shadows, by P. Riess.

Archives des Sciences Physiques et Naturelles, February 15.—A hypothesis on the origin of species, by M. Thury.—Determination of the quantity of organic substances contained in waters of the Rhône, by MM. Graebe and Guye.—Dry plants found in mummies, by Dr. Schweinfurth.—Study on the chemical composition of albuminoid substances (continued), by M. Danilewsky.—Swiss geological review for 1881, by M. Favre.

Journal de Physique, February.—Thermodynamic acceleration of the earth's motion of rotation, by Sir W. Thomson.—Imitation of the forces acting in a dielectric, by M. Elie.—Electric lighting, by M. Foussereau.—Projection of the focus of the prism, by M. Crova.—On a phenomenon of physiological optics, by MM. Macé de Lepinay and Nicati.

Natura, February.—On the origin of metamera, by G. Cattaneo.—On the origin of electricity of thunder-clouds (continued) by F. G. Nachs.—Some notes on radiophony, by E. Mirabelli.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, vol. xv. fasc. 1.—*Résumé* of meteorological observations at Milan, in the Brera Observatory, by P. Frisiani.—On linear systems, by E. Pertini.

Fasc. 2.—New indicator, at a distance, of the temperature of an inclosure, by R. Ferrini.—On two nummulitic deposits in the Pavian Apennines, by E. T. Taramelli.—Phosphates and wheat, by G. Cantoni.—On the theory of the diatomic scale, by E. Beltiami.—The double quadratic transformation of space and its application to non-Euclidean geometry of space (continued), by C. F. Aschieri.—Results of observations during 1881 at the Brera Observatory, on the diurnal excursions of the magnetic needle, by E. G. Schiaparelli.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, March 16.—Sir John Lubbock, Bart., M.P., F.R.S., president, in the chair.—Messrs. H. M. Brewer, V. I. Chamberlain, and A. P. Withiel Thomas were elected Fellows of the Society.—Mr. J. Worthington Smith called attention to certain very destructive Australian fungi new to England, viz. *Capnodium australe*, fatal to conifers, especially *Thuyas* and *Isaria fuciformis*, a great pest to grass in Kent and Sussex. The latter plant is popularly supposed to induce a disease similar to diphtheria, and said to be fatal to cattle. *Isaria* frequently grows on animal substances, dead and living, as on larvæ and pupæ of ichneumons, spiders, moths, wasps, &c.—Mr. Smith showed a bee caught alive in this country, and having a profuse growth of the *Isaria* condition of the *Cordiceps sphecocephala*, a West Indian form, the latter genus being closely allied to *Claviceps*, or Ergot.—Dr. Francis Day read a paper upon the Salmones found in the British Isles, remarking how great changes are occasioned by retaining any of them in unsuitable localities. He objected to the augmentation in number of the British forms of migratory trout, from three to seven, as made by Dr. Günther, holding that we merely possess two. The Lochleven trout, which is in reality a marine form, acclimatized to fresh water, whereas the remainder are solely trout races of the common brook trout.—A most interesting fact was brought forward, viz. that Mr. Arthur, in New Zealand, having lately examined the trout which were introduced there in 1869 from ova originally obtained from the Thames and the west of England, found great structural changes had taken place. The fish in question, moreover, living in different streams in New Zealand had also assumed local peculiarities of size and change of form; and, doubtless due to increased food, the annual

increment of weight had risen from 1½ to 2½ pounds, and an example had been seen weighing 20 pounds. The cœcal appendages hitherto held as significant of species were found augmented from 33 to 50, as exemplified in British fish, to from 43 to 54 in the New Zealand examples, therefore showing that these organs are inconstant as to number. Having alluded to the different species, Dr. Day concluded that, as the various species of non-migratory trout, accepted by Dr. Günther, interbreed, and the results classed hybrids are not sterile, such gives increased reason for supposing these various forms are local races, and not different species; that if they are really distinct species division has not proceeded sufficiently far, because the Gillaroo, or form of trout with a thickened middle coat of the stomach, has been termed *Salmo stomachicus*, Günther, whereas the great lake trout with a thickened stomach, and the Charr having a similarly transformed organ, have not yet been differentiated into species. Dr. Day considers that all our non-migratory freshwater trout (including the Loch Leven) are merely local races; that interbreeding will produce mongrels, in which sterility need not be anticipated, while introducing new races (unless in the principle of preventing breeding in and in) will not be of much benefit to fisheries, unless the food is in excess of local requirements, for if not the new-comers will revert to the colour, form, and size of the original tenants of the water.—Two papers by Mr. Charles Darwin—(1) on the action of carbonate of ammonia on the roots of certain plants; and (2) the influence of carbonate of ammonia on chlorophyll bodies were read, abstracts of which appeared in last week's NATURE.—The twelfth part of the Rev. A. Boog Watson's contributions to the mollusca of the *Challenger* Expedition was also read.

Geological Society, March 8.—J. W. Hulke, F.R.S., president, in the chair.—George Clementson Greenwell and John Baldry Redman were elected Fellows of the Society.—The following communications were read:—Additional note on certain inclusions in granite, by J. Arthur Phillips, F.R.S. The author referred to certain rounded inclusions in granite which were rich in mica. These he had described in his paper published in vol. xxxvi. of the *Quarterly Journal*, and had considered to be contemporaneous segregations from the molten rock. He had, up to that time, not found a case where one of the larger crystals of felspar in a porphyritic granite occurred partly in the one, partly in the other. Of late he had seen several, one of which he described minutely, thus proving the correctness of his supposition.—The geology of Madeira, by J. S. Gardner, F.G.S. Madeira consists almost wholly of sheets of basalt lava of variable thickness, interstratified with tuff scoria and red bole, cut by innumerable dykes. In the central part of the island is a horse-shoe-shaped valley, more than four miles in diameter, its bed 2500 feet above the sea, its precipitous walls full 3000 feet high, rising here and there to yet greater elevations, and forming a central point in the mountain system of the island. This the author regards as the basal wreck of a volcanic mountain, blown into the air by an explosion of exceptional violence. Fragments of the slopes of scoriæ, which once composed the inner shell, remain on the peaks surrounding this amphitheatre. The dykes here are trachyte. The author describes a limestone exposed in one place beneath the basalts, and referred to the Upper Miocene, and a plant-bearing bed associated with them, containing fossils of species still living in the islands, some of which have been wrongly referred to extinct forms. In conclusion, the author remarked upon the almost infinite variability of the genus *Robus*, and the difficulty of distinguishing its species.—On the crag shells of Aberdeenshire, and the gravel beds containing them, by Thomas F. Jamieson, F.G.S.—On the red clay of the Aberdeenshire coast, and the direction of ice-movement in that quarter, by Thomas F. Jamieson, F.G.S.

Victoria (Philosophical) Institute, March 20.—A paper on "Climatic Influences as regards Organic Life" was read by Dr. Gordon, C.B., honorary Physician to the Queen.

EDINBURGH

Royal Society, March 6.—Prof. Fleeming Jenkin, vice-president, in the chair.—Dr. Macfarlane communicated the results which he and Mr. D. Rintoul had obtained from experiments on the effect of flame on the electric discharge. A circular disk was supported near a Bunsen burner on an insulating rod, the centre of the disk, which lay in a vertical plane, being on the same level with the top of the burner. The disk could be charged positively or negatively (as desired) from a Holtz machine, and was in electrical connection with a quadrant electrometer, so that the differences of potential necessary for a discharge to take place between the disk and burner could be measured for each of the various experiments made. The effect of varying the distance between the disk and burner was carefully noted amongst other effects; but the most curious results seemed to be the marked difference in the behaviours of the flame under influence of the charged body according as the flame was luminous or non-luminous, or according as the charge was positive or negative. For example, though the non-luminous flame was (broadly speaking) affected similarly by the negative and positive charge, the luminous flame gave very different results in these cases, being drawn *towards* the negatively charged disk as if dominated by a strong blow-pipe blast, but being forced *down* upon the top of the burner when the disk was positively charged. The electrometer readings also showed interesting variations, being in general greater when the disk was charged negatively than when it was charged positively—Mr. J. Macfarlane, B.Sc., read a paper entitled observations on vegetable and animal cells, their structure, division, and history (Part 1). The paper dealt with the cells of Chara, a nucleus, nucleolus, and endonucleolus being shown to be present in all the active cells of the apical bud. After division of the sub-apical cell into node and internode, the former continued to divide, while the latter was completely arrested, though the earlier steps in division were taken, so that by virtue of the steady proliferation of the endonucleous and nucleolus the nuclei in such internodal cells as the third removed from the apex were multinucleolar. These nuclei then divided in the manner figured by Johow, so that the sixth internodal cell might be multinuclear, with multinucleolar nuclei. This same phenomenon was shown to occur in all the cells of the plant. Comparing his results with other observers, the author concluded that during division, the endonucleolus divides first; then the nucleolus, each of the daughter nucleoli forming an important centre of influence round which the nucleoplasm gathers; and finally, the nucleus, depositing in so doing a septum, and forming a nuclear spindle or barrel, which is most evident where the cell is most vacuolated. In reference to this continued activity of the cell-contents after cessation of cell division, which seemed to be universal among plants, relative nutrition was considered an important factor—cells with only a moderate supply of pabulum remaining multinucleolar, and the more highly nourished becoming multinuclear, a state of plant-cells which the author regarded as being commoner than had, even recently, been supposed.—Mr. Patrick Geddes communicated a paper by Mr. F. E. Beddard, B.A., Oxon, on some points in the anatomy of the nervous system of the pond-snails, Planorbis and Lymnæus.—Mr. E. Sang, in a paper entitled "A Critical Examination of Two Cases of Unusual Atmospheric Refraction described by Prof. Vince," argued that, as the drawings represented in their design and perspective nothing that could ever be seen, and as the diagrams and verbal descriptions were not consistent with each other, the well-known phenomena described by Vince were not cases of mirage at all.—Prof. Crum Brown read a description by the patient himself of a case of dyspeptic vertigo, and added in a few sentences the physiological explanation of the curious sensations experienced.

BOSTON, U.S.A.

American Academy of Arts and Sciences, February 9.—President Lovering in the chair.—Prof. A. E. Dolbear exhibited his new telephone. The peculiarity of this instrument consists in the receiver. This is formed of two parallel metallic plates separated from each other by a thin layer of air. One plate is fixed, and is connected with one terminal of a small Ruhmkorf coil; the other plate can vibrate, and is connected with the other terminal of the coil. When a transmitter is placed in the primary circuit of the Ruhmkorf coil, the attractions between the two metallic plates reproduce the sound-waves sent into the transmitter. Conversation has been carried on over 250 miles of land lines and 350 miles of submerged cable with the aid of this instrument.—Prof. F. W. Putman, curator of the Peabody Museum of Archæology at Cambridge, exhibited a number of specimens of pottery of the mound-builders of North America, which illustrated conventionalisms in ancient American art.—An interference prism for producing interference striæ was exhibited by Mr. C. E. Kelley. This consisted of two pieces of glass, separated at one end by one thickness of tinfoil, and at the other by two thicknesses of foil. By sliding the prism in front of the slit of a spectroscope, any suitable number of striæ could be produced.—Mr. N. D. C. Hodges reduced Maxwell's

law of distribution of energy among the particles of a gas from the principle of least action.—The following papers were presented by Prof. H. B. Hill, of Harvard University: Dibromacrylic acid; relations of dibromacrylic acid to two different tribromopropionic acids; certain tetra-substituted propionic acids; on the constitution of the substituted acrylic acids.—Dr. Asa Gray, of Harvard University, contributed the following: Studies of Solidago and Aster; *Novitiæ arizonicæ*, &c., characters of new plants chiefly from recent collections in Arizona and adjacent districts.

VIENNA

Imperial Institute of Geology, February 21.—The following papers were read:—F. v. Hauer, on the meteorites of Mocs (Transylvania).—Th. Fuchs, Bathymetrical distribution of the deep-sea fauna.—A. Bitter, on the Tertiary formation of the Vicentinian Alps.—Prof. Szabo, on the principles which enable us to determine the trachytes in their chronological relation.

March 7.—F. v. Hauer, communications on the Rhætic fossils of the Ligurian Alps.—O. Lenz, on a geological map of Western Africa.—V. Uhlig, on the Cephalopod fauna of the strata of Rossfeld.

Imperial Academy of Sciences, March 9.—L. T. Fitzinger in the chair.—The following papers were read:—E. Hering, contributions to general nerve and muscle physiology. Part ix. nerve excitation and nerve current.—R. Schram, auxiliary tables to chronology.—L. Heitinger, preliminary note on glutamic acid and pyrrol.

March 16.—L. T. Fitzinger in the chair.—Ph. Knoll, contributions to the theory of respiratory innervation. Part i. respiration during excitation of the cervical part of vagus by its own current.—T. V. Janovsky, on sulphonic acids of azobenzol.—V. Zepharovich, supplement to the already published crystal forms of some camphor-derivates, especially on the forms of camphor-bibromide.—M. Tüllich, a sealed packet dealing with a mechanical problem.—E. v. Dunikowski, on the Spongia, Radiolaria, and Foraminifera of the Lower Liassic strata of the "Schafberg," near Salzburg.—T. Kachler and T. Spitzer, on two isomeric camphor bibromides from camphor monobromide.—L. v. Pebal, on the use of electromagnets for mechanical separation of minerals.—E. Brücke, on testing urea by oxalic acid.—E. Stefan, on the magnetic screen-action of iron.—K. Ginzel, astronomical researches on eclipses.—A. v. Obermayer, on the diffusion of gases, Part ii.

PARIS

Academy of Sciences, March 20.—M. Jamin in the chair.—The following papers were read:—On some applications of the theory of elliptic functions, by M. Hermite.—Double decompositions of haloid salts of mercury; conclusions, by M. Berthelot.—Note on the use of superphosphates on calcareous soils of the south coast of France, by M. de Gasparin. The practice has sprung up there within the last two or three years; it proves beneficial to natural or artificial meadows. In a commercial superphosphate analysed, the author found two parts, out of twelve, of phosphoric acid, engaged in the state of phosphates insoluble in water; and ten in that of trihydrated phosphate, to which the agricultural effects are due. The lime and part of the iron were in the state of sulphates.—Letter of N. Fuss on large objectives, found by M. Truchot among the papers of Romme, Member of the Convention, by M. Faye. Fuss, an eminent member of the St. Petersburg Academy, consulted by Romme, indicated the limits then attainable, and gave precise calculations, by Euler's method, of a triple objective, 16 inches diameter, of short focus, with six well-conceived oculars. Romme probably meant to excite, by Fuss's letter, the emulation of French opticians, but events made him lose sight of this.—Theory explicative of the climatological *régime* observed in France on the Oceanic coast since 1880, and the disappearance of the sardine on this coast since the same time, by M. Blavier. See our Notes last week. The supposed displacement of the Gulf Stream is attributed to an exceptional quantity of ice in the region of Davis Straits, obstructing the polar current.—On the action of deformation through shock, compared with that through continuous pressure, by M. Marchal.—Observations of the planets 221 and 223, at Paris Observatory, by M. Bigourdan.—On hypercycles, by M. Laguerre.—On the theory of uniform functions of a variable, by M. Mittag-Leffler.—On mechanical integration, by M. Abakanowicz. He describes an apparatus demonstrating the principle of his integrators (a principle lately applied by Mr. Boys).—Relation between the law of Bouguer-Masson and the phenomenon of Purkinje, by MM. Macé de Lépinay and Nicati. This law applies to each of the simple spectral radiations (at least within the limits of experiment). The constant ratio indicated in it is the same for all radiations of wave-length greater than $\lambda = 5{\cdot}12 \times 10^{-5}$ approximately; beyond that, the ratio increases towards the violet.—Observations *à propos* of a recent note, by M. Violle, on the boiling temperature of zinc, by M. Troost. M. Violle seems to have overlooked later experiments by MM. Deville and Troost, which gave a figure (942°) little different from that obtained by M. Becquerel.—On new combinations of nitric acid and acetic acid with ammonia, by M. Troost. He indicates two of each kind, and their properties.—Action of acid solutions on protoxide of tin, by M. Ditte.—Action of ozone on salts of manganese, by M. Maquenne. Ozone easily produces transformation of protoxide of manganese into permanganic acid, conformably to thermal theory; and the transformation is complete.—Heat of formation of sulphocyanic acid and some sulphocyanates, by M. Joannis.—On the clarification of must for manufacture of champagne, by M. Jean. For this it is necessary to determine the amount of tannin which will be made insoluble by albuminoid matters, and the amount necessary to precipitate the whole of the gelatine added in fining. M. Jean uses a titrated solution of iodine for the purpose.—On the Kola nut, or Gourou, or Ombéne (seeds of *Sterculia acuminata*, Pal. de Bauvois), by MM. Heckel and Schlagdenhauffen. This nut, playing in Africa a rôle like that of *Maté* and *Coca* in America, contains more caffeine than the best coffees, and wholly in the free state; a good deal of theobromine, and a notable quantity of glucose; it has three times the starch of seeds of *Theobroma*, little fatty matter, a special tannin, and a red colouring matter.—On the richness in hemoglobin of the blood of animals living in high regions, by M. Bert. While the maximum quantity of oxygen absorbable by blood of herbivorous mammalia in France is 10 c.c. to 12 c.c. per 100 c.c. of blood, he finds the blood of several animals (lama, alpaca, stag, sheep, &c.) above Paz, Bolivia, which is 3700 m. high, capable of absorbing amounts from 16·2 c.c. to 21·6 c.c. These latter have thus a more abundant store for the requirements of their life.—On pancreatic digestion, by M. Duclaux.—On the existence of segmentary organs in certain isopod crustaceans, by M. Huet.—On the *Macroscincus coctei*, D. B., recently arrived at the menagerie of the Museum of Natural History, by M. Vaillant.—On the crystalline forms of zirconia, and deductions to be drawn from them for the qualitative determination of zircon, by MM. Lévy and Bourgeois.—On the barometric heights of January 17, 1882, and of the year 1821, in the South of France, by M. Vignier.

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