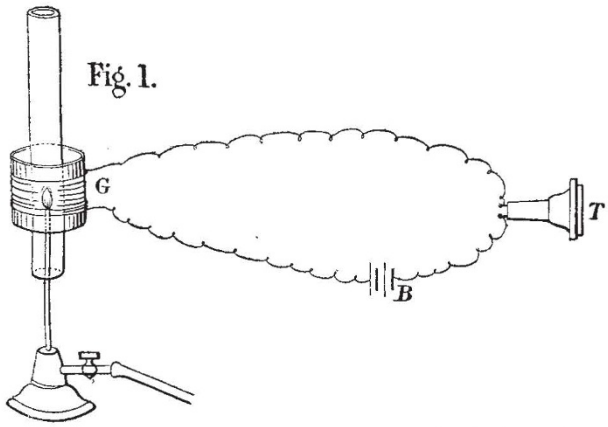
PHOTOPHONE EXPERIMENTS

MR. ANDREW JAMIESON, C.E., Principal of the Glasgow Mechanics Institution, sends us an account of the following experiments on the photophone, shown by him at a lecture delivered by him on January 19, before the Glasgow Philosophical Society, on the history of selenium.

The effects of light and heat on the conductivity of selenium were shown by means of a simple and inexpensive form of "cell" joined up in a Wheatstone's Bridge with a reflecting galvanometer. The cell is constructed in the following way:—A piece of plate-glass or of a glass tube of about an inch diameter and about three inches long is chosen, and upon its exterior are tightly wound two separate parallel wires of No. 25 B.W.G., the wires themselves being of copper covered with silk or cotton. A red-hot iron or poker is then applied to the middle region of the coil of wire so as to burn off the insulating covering of silk

Fig. 1.



or cotton. The bare wires are cleaned, and the blank cell being raised to the proper temperature, vitreous selenium is rubbed on the wires so as to fill the narrow interspaces left by the removal of the silk covering. The selenium is afterwards annealed in the the usual fashion to render it more highly conductive. One of the cells thus used had resistances of 5740 and 3440 ohms respectively in the dark and in the light; but others have less resistances, one being as small as 500 ohms in the dark. The first-named cell (a flat one) was twenty-one days old, and had increased several thousand ohms in that time.

The musical note of a "singing flame" was reproduced in the telephone by means of one of the annular cells thus formed upon a glass tube in the following manner, suggested by Prof. Blyth (Fig. 1):—The cell, C, joined in circuit with a battery, B, and telephone, T, was placed outside entirely surrounding the glass tube in which a small gas-jet was "singing." Speech was afterwards reproduced by the arrangement shown in Fig. 2. At the

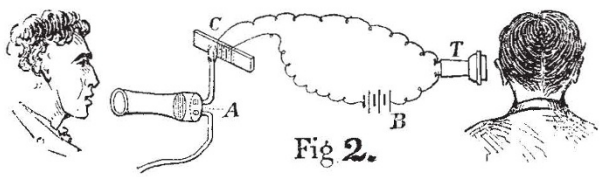


Fig 2.

back conical mouthpiece which receives the voice is fixed a membrane of goldbeater's skin which forms the front of a chamber, A, into which gas is led, and from which a short tube leads to a small gas-jet, in the manner devised by König. Opposite the gas-flame was placed the selenium cell in circuit with a battery of twenty cells and a distant telephone. There were thus eleven changes going on simultaneously:—

1. Muscular movement of speaker's vocal organs.
2. Vibration of air opposite speaker's mouth.
3. Corresponding vibrations of the thin membrane.
4. Variations of pressure controlling the supply of gas to jet.
5. Hence increase and decrease of gas-flame.
6. Increase and decrease of resistance of the selenium cell.
7. Rise and fall of battery current.
8. Increase and decrease of magnetism in magnet of telephone.
9. To-and-fro movement of telephone disk.
10. Vibration of air opposite the same.
11. Vibration of drum of ear of listener at the telephone and a sound heard.

Not only the pitch but the tone of the voice was distinctly heard.

THE COFFEE-LEAF DISEASE

TWO interesting papers on this subject were read at the last meeting (3rd inst.) of the Linnean Society, the one treating of its ravages in India, the other its nature and spread in South America.

In the first Mr. Wm. Bidie, in a letter to Mr. J. Cameron of Bangalore, refers to the Coorg country, situated in the Western Ghats, where European enterprise in coffee has been wholly developed within the last twenty-five years, and no disease was observed till four or five years ago. The author mentions that the disease appears to have been imported from Ceylon by way of Chickmoorloor, a district of Mysore, sixty miles distant from Coorg. It seems worst in impoverished, exposed fields, and least where there is shade and rich soil. A small red insect has been noticed feeding over leaves covered with the pest, but what the insect's relation is to the disease as yet remains undetermined. Plants grown from Ceylon seed suffer most, while those trees of Coorg origin and growth are least affected. A system of "renovation-pitting" has been successfully tried, a pit being dug at short intervals wherein, after judicious pruning, all the affected leaves are buried, and this precaution seems to check the spread of the disease, particularly among the Coorg coffee-trees.

In the second communication Dr. M. C. Cooke describes and summarises all the data extant up to the present time of the progress of coffee disease in South America. Plantations in Venezuela, Costa Rica, Bogota, Carácas, and Jamaica have been affected. He discourses on the nature of the blight, and is of opinion that the disease is a complicated one, being himself as yet unprepared to affirm that either the *Septoria*, the *Sphærella*, or the *Stilbum*, three so-called different kinds of fungi, or altogether, is the true cause of the disease. At the same time he thinks it possible that none of these forms of fungus are autonomous, and that all may be related to each other as forms or conditions of the same fungus, of which *Sphærella* is the highest and most perfect manifestation. He observes that the discoloured spots may be without any visible fungus upon them, and exhibit no trace of mycelium in the tissues, or they may nourish a *Septoria*, as seen by the Rev. M. J. Berkeley, or a *Sphærella* as found by himself, or finally a species of *Stilbum* as seen by Prof. Saenx and himself. Further, the *Stilbum* may occur on the same spot as the perithecia of the *Sphærella*, or both perithecia and *Stilbum*; the one without the other may be found occupying different spots. Mr. Cooke admits that altogether it is difficult satisfactorily to answer the question, What is the cause of this form of coffee disease?

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—Sir William Harcourt announced on Monday that the evidence taken before the Oxford University Commissioners would be laid before Parliament without delay.

CAMBRIDGE.—The first Smith prize has been adjudged to A. R. Forsyth, of Trinity College, Senior Wrangler. R. S. Heath, of Trinity College, Second Wrangler, and A. E. Steinthal, also of Trinity College, Third Wrangler, were equal in the competition for the second prize.

Mr. W. J. Lewis, M.A., of Trinity College, Cambridge, and Fellow of Oriel College, Oxford, has been elected to the Chair of Mineralogy, in the place of the late Prof. Miller, F.R.S. The University is to be congratulated on having secured as Professor of Mineralogy one so competent to take Prof. Miller's place.

Mr. A. Scott is giving demonstrations in Elementary Organic Chemistry at the University Laboratory. Mr. J. F. Walker is lecturing on the same subject at Sidney Sussex College.

Lord Rayleigh is giving a short course on the Unit of Electrical Resistance, and on February 21 will commence an advanced course of lectures on Sound. Mr. Glazebrook is giving demonstrations on Advanced Electricity and Magnetism, and

Mr. Shaw on Heat. All these courses are given in the Cavendish Laboratory.

Prof. Stuart is lecturing on the Differential Calculus and its Application to Mechanics; the Demonstrator has a course on Elementary Applied Mechanics.

Dr. Michael Foster continues his course of Elementary Physiology. The advanced lectures announced this term are by Mr. Lea (who has been appointed Lecturer in Physiology at Gonville and Caius College), on Physiological Chemistry; Mr. Langley, on the Histology and Physiology of the Digestive System, and Mr. Hill (Downing College), on the Central Nervous System.

The Report of the Syndicate on the Higher Education of Women is to be discussed to-morrow (February 11).

The Board of Natural Science Studies recommends that the agreement between the University and Dr. Dohrn, of the Zoological Station at Naples, by which 75*l.* per annum is paid from the Worts Travelling Bachelors' Fund towards the expenses of the station, be renewed for five years. The Board calls attention to the services which those members of the University who have studied at Naples have rendered to science and the University, and to the fact that three of them have obtained professorships elsewhere, namely Professors A. M. Marshall (Owens), T. W. Bridge (Mason's College, Birmingham), and A. C. Haddon (Dublin).

At Newnham College Miss Harland is lecturing on Euclid and Algebra, and Miss Scott on Analytical Conics, Mr. Garnett lectures on Statics and on Experimental Physics, Mr. Hudson on Arithmetic and on the Differential Calculus, Mr. Hillhouse on Botany, while Miss Cross superintends practical and paper work in Chemistry and Geology.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 9, 1880.—"The Electrostatic Capacity of Glass," by J. Hopkinson, M.A., D.Sc., F.R.S.

In 1877 I had the honour of presenting to the Royal Society (*Phil. Trans.*, 1878, Part i.) the results of some determinations of specific inductive capacity of glasses, the results being obtained with comparatively low electromotive forces, and with periods of charge and discharge of sensible duration. In 1878 Mr. Gordon (*Phil. Trans.*, 1879, Part i.) presented to the Royal Society results of experiments, some of them upon precisely similar glasses, by a quite different method with much greater electromotive forces, and with very short times of charge and discharge. Mr. Gordon's results and mine differ to an extent which mere errors of observation cannot account for. Thus for double extra dense flint glass I gave 10·1, Mr. Gordon 3·1, and subsequently 3·89 (Report of British As ociation for 1879). These results indicate one of three things, either my method is radically bad, Mr. Gordon's method is bad, or there are some physical facts not yet investigated which would account for the difference. Two suggestions oocur:—1. Possibly for glass K is not a constant, but is a function of the electromotive force. 2. When a glass condenser is discharged for any finite time, a part of the residual discharge will be included with the instantaneous discharge, and the greater the time the greater the error so caused. To test the first I measured the capacity of thick glass plates with differences of potential ranging from 10 to 500 volts, and also of thin glass flasks between similar limits; the result is that I cannot say that the capacity is either greater or less where the electromotive force is 5000 volts per millimetre than where it is $\frac{1}{2}$ volt per millimetre. The easiest way to test the second hypothesis is to ascertain how nearly a glass flask can be discharged in an exceedingly short time. A flask of light flint glass was tested; it was charged for some seconds, discharged for a time not greater than $\frac{1}{17000}$ second, and the residual charge observed so soon as the electrometer needle came to rest; the result was that the residual charge under these circumstances did not exceed 3 per cent. of the original charge, also that it mattered not whether the discharge lasted $\frac{1}{17000}$ second or $\frac{1}{80}$ second. These experiments suffice to show that neither of the above suppositions accounts for the facts.

I have repeated my own experiments with the guard-ring condenser, but with a more powerful battery, and with a new key which differs from the old one, inasmuch as immediately after the condensers are connected to the electrometer they are separated from it. In no case do I obtain results differing much from those I had previously published.

Lastly, a rough model of the five plate induction balance used by Mr. Gordon was constructed, but arranged so that the distances of the plates could be varied within wide limits. So far as instrumental means at hand admitted Mr. Gordon's method was used. A plate of double extra dense flint and a plate of brass were tried. In the first, by varying the distances of the five plates, values of K were obtained ranging from $1\frac{1}{4}$ to $8\frac{1}{4}$, with the latter results from $\frac{1}{10}$ to 3. It is clear that the five plate induction balance thus arranged cannot give reliable results.

The explanation of the anomaly, then, is that the deviation from uniformity of field in Mr. Gordon's apparatus causes errors greater than any one would suspect without actual trial. It is probable that the supposed change of electrostatic capacity with time may be accounted for in the same way.

January 27.—"Dielectric Capacity of Liquids." By J. Hopkinson, F.R.S.

These experiments have for object the determination of the refractive indices and the specific inductive capacity of certain liquids, and a comparison of the square of the refractive index for long waves and the specific inductive capacity.

In the following table are given the results obtained for refractive index for long waves deduced by the formula $\mu = \mu_\infty + \frac{b}{\lambda^2}$, the square of μ_∞, and the observed values (K) of the specific inductive capacity.

	μ^2_∞	K
Petroleum spirit (Field's)	1·922	1·92
Petroleum oil (Field's)	2·075	2·07
,, (Common)...	2·078	2·10
Ozokerit lubricating oil (Field's) ...	2·086	2·13
Turpentine (Commercial)	2·128	2·23
Castor oil	2·153	4·78
Sperm oil	2·135	3·02
Olive oil	2·131	3·16
Neatsfoot oil	2·125	3·07

It will be seen that whilst for hydrocarbons $\mu^2_\infty = K$, for animal and vegetable oils it is not so.

Zoological Society, February 1.—Prof. W. H. Flower, LL.D., F.R.S., president, in the chair.—Mr. F. M. Balfour, F.R.S., read a paper on the evolution of the placenta and made some observations on the possibility of employing the characters of this organ in the classification of the mammals.—Mr. Sclater read notes on some birds collected by Mr. E. F. im Thurn in British Guiana, amongst which was an example of a new species of *Agelæus*, proposed to be called *A. im-Thurni*, after its discoverer.—Mr. W. T. Blanford, F.R.S., read an account of a collection of reptiles and frogs made at Singapore by Dr. W. B. Dennys. In this collection were two new species of Ophidians, which were named respectively *Cylindrophis lineatus* and *Simotes Dennysi*, and two new frogs, which the author proposed to call *Rana laticeps* and *Rhacophorus Dennysi*.—Mr. A. D. Bartlett read an account of a peculiar habit of the Darter (*Plotus anhinga*) in casting up parts of the epithelial lining of its stomach, as observed by him in the specimen now living in the Society's collection.—A communication was read from Mr. A. Heneage Cocks, F.Z.S., containing notes on the breeding of otters, as observed by him in specimens living in his possession.—The Secretary read a paper by the late Mr. Arthur O'Shaughnessy, containing an account of a large collection of lizards made by Mr. C. Buckley in Ecuador. The collection was stated to be of great interest, both on account of the number of new species it contained and the fresh material it afforded for the study of species already known. Mr. O'Shaughnessy had given last year a partial notice of this collection, confined however to a preliminary list of the species of *Anolis* identified. The present paper gave the results of a study of the whole collection, and was not restricted to a description of the new forms, but enumerated all the species, for the purpose of recording additional remarks and revisions which appeared necessary. In it twenty-seven species were mentioned, ten of which were new.—Mr. G. A. Boulenger read an account of a new species of *Enyalius* in the Brussels Museum, from Ecuador, which he proposed to name *Enyalius O'Shaughnessyi*.—Lieut.-Col. H. H. Godwin-Austen, F.R.S., read the first part of a memoir on the land-shells collected on the island of Socotra by Prof. I. B. Balfour. The present communication comprised an account of the species of *Cyclostomaceæ* found on the island.

Photographic Society, January 11.—J. Glaisher, F.R.S., president, in the chair.—Papers were read by E. Viles on the