

An apparatus devised by Prof. Tyndall for experimentally demonstrating the laws of reflexion and refraction is admirably adapted for verifying this law. The following description is quoted from his Lectures on Light:—"A shallow circular vessel RIG (Fig. 6) with a glass face, half filled with water rendered barely turbid by the admixture of a little milk or the precipitation of a little mastic, is placed upon its edge with its glass face vertical. By means of a small plane reflector M, and through a slit I in the hoop surrounding the vessel, a beam of light is admitted in any required direction." If a little smoke be thrown into the space above the water, the paths of the incident, the reflected, and the refracted beams will all be visible. If then the direction of the incident beam be so adjusted that the reflected and the refracted beams are at right angles to one another, and a Nicol's prism be interposed in the path of the incident beam, it will be found that by bringing the vibrations alternately into and perpendicular to the plane of incidence we shall alternately cut off the reflected and the refracted ray. Thus much for the verification of the law. But not only so, if we take different fluids and for each of them in succession adjust the incident beam in the same manner, we shall only have to read off the angle of incidence in order to ascertain the polarising angle of the fluid under examination.

The polarising angle for glass is $54^{\circ} 35'$.

Thus, in Fig. 7, let a, b be the incident, and b, c the reflected ray at the first plate; b, c the incident, and c, d the reflected ray at the second plate; then the ray will be polarised more or less according to the angle of incidence, at b, and will be analysed at c.

But in accordance with the principle stated above, viz. that any process which will serve for polarising, will serve also for analysing, we may replace the analysing tourmalin by a second plate of glass (or whatever substance has been used for the first reflexion) placed parallel to the first, and in such a position as to receive the reflected ray; and if the second plate be then turned round the ray reflected from the first plate b c, as an axis, it will be found that at two positions of rotation (first when the plates are parallel and secondly when one of them has been turned through 180°) the light reflected from the second plate is brightest, and at two positions at right angles to the former the reflected ray is least bright. The degree of dimness at the two positions last mentioned will depend upon the accuracy with which the reflecting plates have been adjusted to the polarising angle; and when this has been completely effected, the light will be altogether extinguished.

Suppose now that the reflecting substance be, as in the case of glass, transparent. Then it will not be surprising if, when the reflected ray is polarised, the refracted ray should also exhibit traces of polarisation. And in fact every ray of ordinary light incident upon a transparent plate is partly reflected and partly refracted; the reflected ray is partially polarised, and so also is the refracted ray. This being so, if, instead of a single plate, we use a series of plates placed one behind the other, each plate will give rise to a series of reflected rays, due to successive internal reflections. The sum of all these will give the intensity and the amount of polarisation of the total reflected light. The phenomenon of these reflexions is therefore rather complicated; and the modifications due to the additional plates do not materially alter the proportion of polarised to unpolarised light. It is, however, otherwise with the refracted rays. The rays transmitted by the first plate enter the second in a state of partial polarisation, and by a second transmission undergo a further degree of polarisation. If this process be continued by having a sufficient number of plates, the ray finally emergent may have any degree of polarisation required.* And it is worthy of remark that, in proportion as

* Plates of the thinnest description are the best; two or three give good effects, but if the surfaces lie parallel and the glass be highly transparent the number may be advantageously increased to 10, or even 12.

the rays become more and more polarised, so does a less and less quantity of light become reflected from the surfaces of the plates; and consequently, except in so far as light is absorbed by actual transmission through the substance of the plates, the emergent ray suffers less and less diminution of intensity by each additional plate. So that when a certain number has been attained the intensity received by the eye or on a screen is practically unaffected by increasing their number.

Fig. 8 is a general representation of such a pile of plates viewed edge-ways. The plates are secured in a brass frame, and the whole supported on a stand.

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(To be continued.)

THE ROYAL SOCIETY

THE following extracts from the Minutes of the Council of the Royal Society under the dates given, may be interesting to some of our readers:—

Jan. 26, 1860.—The President having brought under the consideration of the Council the present scale of remuneration of the Secretaries, it was resolved:—"That a Committee be appointed to inquire into the matter and report thereon to the Council; the Committee to consist of the President and the Treasurer, with Mr. Barlow, Mr. Bell, and Dr. Farr."

Feb. 23, 1860.—The President presented the following Report from the Committee appointed on January 26 to consider the question of the remuneration of the Secretaries.

"Your Committee beg to Report to the Council that, in performing the task which was imposed upon them, they have inquired into the duties of the Secretaries at various times, the gratuities which have been awarded to them, and the financial condition of the Society.

"They have been favoured with valuable information and opinions by former Officers of the Royal Society,—Sir John Herschel, Mr. Brande, Dr. Roget, and Sir John Lubbock.

"Previous to the year 1720 no regular salaries were assigned to the Secretaries, but it was customary to present them from time to time with sums varying from 10*l.* to 20*l.* under the name of 'Gratuities.'

"In 1720, on the motion of the President, Sir Isaac Newton, the Council directed that 50*l.* should be paid to each of the two Secretaries annually. In 1732 this amount was increased to 60*l.*, and in 1760 to 70*l.* 10*s.* In November 1799, on the motion of the President, Sir Joseph Banks, the amount of the salaries was reconsidered by the Council, and raised to *One Hundred Guineas* to each Secretary, at which amount they have remained from that time to the present.

"The office of 'Foreign Secretary' originated in a legacy of 500*l.* bequeathed to the Society in 1719 by Mr. Robert Keck, for the express purpose of remunerating a person for carrying on foreign correspondence. In 1720 the first Foreign Secretary was appointed, with a salary of 20*l.* a year, which sum has been paid, without increase, from that time to the present.

"It is the concurrent opinion of all who have the best means of knowing, that since the gratuities were last fixed in 1799 the business of the Society and the duties of the Secretaries have largely increased. The increase of Fellows and the larger income of the Society have enabled it to extend its operations. In the ten years 1790 to 1799, 319 papers were communicated to the Society; and in the ten years 1850 to 1859, the number of such papers was 672. Some of the communications are short notices for publication in the Proceedings, and it is impossible to determine precisely in what ratio the work has increased; but your Committee are disposed to believe that it is represented approximately by the above figures.

The Secretaries now edit the 'Transactions' and the 'Proceedings' which are found so useful by the Fellows, and this latter duty has added considerably to their labour.

"The current revenue of the Society may be set down at about 3,514*l.* of which 1,150*l.* are derived from rents and dividends, and 517*l.* from the Stevenson bequest. The latter sum, it is known, will increase as lives fall in. The annual subscriptions amount to 1,126*l.*; the entry fees, estimated on an average of eleven years, will be about 170*l.*; the compositions 360*l.*; the Transactions will yield 276*l.*; making the aggregate revenue under these heads 1,932*l.* Your Committee see no reason to believe that these sources of income are likely to fail.

"The current annual expenditure may be stated at about 2,839*l.*; namely, 1,177*l.* on printing; 764*l.* on gratuities, salaries and wages; 187*l.* on books and binding; 511*l.* on house expenses; 200*l.* on Catalogue of Periodicals. These items necessarily fluctuate, and the printing bill last year exceeded considerably the above amount; but the amount just stated for printing is estimated from an average of the last eleven years. The income of the Society has thus for some years exceeded the expenditure by about 675*l.*

"Looking at the duties which now devolve upon the Secretaries, of regularly attending Meetings, reading papers, editing the 'Transactions,' preparing the 'Proceedings' for publication, and other work,—looking also at the remuneration which it is found desirable to give gentlemen who discharge less onerous duties merely as editors of literary works in the present day,—your Committee are of opinion that the Council will be acting quite in conformity with the sound principles which were laid down in Sir Isaac Newton's presidency, and have been acted on since, by increasing the gratuity to each of the two Secretaries. As the result of the inquiries made by your Committee, they would suggest that the addition should be 95*l.*, raising each gratuity from 105*l.* to 200*l.* This would involve an increase of 190*l.* in the expenditure.

"The relations of the Society with foreign countries may be largely extended, and your Committee are of opinion that to accomplish this object 80*l.* may be advantageously added to the 20*l.* now voted making the annual gratuity of the Foreign Secretary 100*l.*

"The total augmentation of the expenditure under this arrangement would be 270*l.* leaving a probable annual surplus of 400*l.* to be devoted to the numerous purposes which fall naturally within the scope of the Society's inquiries.

"Your Committee are of the opinion that the offices efficiently discharged will still be to a great extent honorary; and that so long as the Society itself is so fortunate as to have able, industrious, and eminent men as its Secretaries it will be still largely in their debt.

"Should the finances of the Society, through any unforeseen circumstance, require it, there would not, your Committee apprehend, be any difficulty in again revising the scale of gratuities which may be awarded."

This Report having been read, it was, on the motion of the Treasurer, seconded by Sir R. Murchison,

"Resolved—That the recommendation of the Committee respecting the honorarium to be given to the two principal Secretaries be adopted."

June 20, 1872.—On the motion of Dr. Sharpey, [pursuant to notice given, seconded by Mr. Spottiswoode—

"Resolved—That the following mode of procedure be adopted in the nomination of Fellows to be recommended to the Society for election as Council and Officers.

"1. The subject of the new Council shall be taken into consideration at a meeting of Council to be held on the last Thursday of October; and with the summons for that meeting there shall be transmitted a list of the members of the existing Council, with the number of their

attendances at meetings up to that date; also a list of the Fellows of the Society, with an indication of those who have at any time served on the Council, and the dates of their service.

"2. At this meeting the names of those members of the existing Council who retire at the ensuing anniversary shall be determined. Thereafter each member present shall hand to one of the secretaries a list of not exceeding ten Fellows whom he proposes for the new Council, of whom five shall not have already served on the Council. Members not able to be present may send in similar lists previous to the meeting. The several lists of names so proposed shall then be read out by the secretary.

"3. Before the next following meeting, the president and officers shall prepare a list of twenty-one names for consideration by the Council, which list shall include ten names selected from those proposed at the previous meeting, or other names, if required to make up that number. The list so prepared, together with a statement of the names proposed and the number of votes given for each, shall be sent out confidentially with the summons for the ensuing meeting, at which meeting the names to be finally recommended shall be balloted for. In taking the ballot, a copy of the list prepared by the officers, with such alterations as he may see fit to make therein, shall be delivered by each member of the Council present and voting, and the names found to have the majority of votes shall form the list to be recommended to the Society.

"The President and Council shall then nominate by ballot, out of the proposed Council, the persons whom they recommend to the Society for election to the offices of President, Treasurer, Principal Secretaries, and Foreign Secretary for the ensuing year."

NOTES

THE present year is already remarkable for the number of eminent scientific men who have gone over to the majority: and now, just as its close, one of the most eminent in his own sphere has taken his departure. A telegram dated New York, December 14, announces the death of Prof. Louis J. R. Agassiz, in his 67th year, he having been born in Switzerland in 1807. We shall content ourselves with the bare announcement at present, hoping to be able to give, next week, a memoir of the great naturalist. Meantime we would draw the attention of our readers to the interesting letter from Agassiz in our correspondence column, sent us by Sir Philip de Malpas Grey-Egerton, Bart.

A MEETING, with Sir William Armstrong as chairman, was held at Newcastle last Thursday, to consider the question of a memorial to the late Mr. Albany Hancock. It was unanimously resolved that the most appropriate memorial that could be raised to Mr. Hancock, would be a Professorship of Natural History in the Newcastle College of Physical Science, to be called, after him and his friend and conjoint worker, the late Mr. Alder, the "Hancock and Alder Professorship." Over 1,000*l.* were subscribed at the meeting, and we have reason to hope, from the general esteem in which the two men were held, the high value of their labours, and the great wealth of Newcastle and the surrounding district, that the remaining 4,000*l.* or 5,000*l.* necessary to endow a Natural History chair, will be raised without difficulty. Very few, even of scientific men, seem to be aware of the great amount and value of the work done by Mr. Hancock. The Rev. A. M. Norman, in speaking at the meeting, said that the nature and extent of the work done by Mr. Hancock, would only be realised by degrees. "His work was abstruse science; work which was labour, day by day, under the microscope; work which was carried on from week to week and from year to year, and which was published in the journals of the scientific associations; work which was at present not thoroughly under-