

REPORT

OF THE

TWENTY-FIFTH MEETING

OF THE



BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE;

HELD AT GLASGOW IN SEPTEMBER 1855.

LONDON:

JOHN MURRAY, ALBEMARLE STREET.

1856.

*Report of the Kew Committee, presented to the Council of the British Association June 27, 1855.*

The Committee beg to submit the following Report of their proceedings since the meeting of the Association at Liverpool.

On the 20th of October last, Mr. John Phillips addressed a letter to the Chairman of the Kew Committee, announcing that a sum of £500 had been placed by the General Committee at the disposal of the Council for the maintenance of the establishment at Kew, and that the General Committee had recommended that application should be made by the President to Her Majesty's Government for the use, rent free, of the two acres of land adjacent to the Observatory, and for the laying-on of gas.

The Committee met on the 8th of November, when the fixed expenditure for the year was estimated at £341 (viz. Mr. Welsh £150, Beckley £91, Magrath £40, and house expenses £60).

It having been represented to the Committee that Her Majesty's Government were anxious that magnetical and meteorological instruments, showing the state to which they had advanced in this country, should be exhibited at the Paris Exhibition, and that the expenses which might be incurred on any instruments or apparatus forwarded by the Committee would be defrayed by the Government, your Committee requested Colonel Sabine, Mr. Welsh, and the Chairman, to attend the Royal Society Paris Exhibition Committee, to explain that the Kew Committee would most readily afford every assistance in their power to carry out the wishes of Her Majesty's Government.

The sum of £140 was ultimately awarded by the Royal Society Committee for this purpose, and the instruments have been prepared and forwarded to Paris.

The following letter from Mr. John Welsh, addressed to the Chairman of the Committee, is presented as a part of this Report.

“Kew Observatory, June 26, 1855.

“DEAR SIR,—Colonel Sabine furnished, from the Stores in the department under his control at Woolwich, several of the instruments which had been in use at the British Colonial Magnetical Observatories; and he also procured to be sent from Messrs. Jones and Barrow such of the smaller portable instruments as are employed in magnetical surveys.

“At the Observatory, specimens of the self-recording magnetical and meteorological instruments of Mr. Ronalds were put in order, several small alterations in their adjustments being necessary in order to adapt them to the circumstances of the Exhibition. The two instruments sent, viz. the Biflar Magnetograph and the Barometrograph, were sufficient to illustrate in every particular the principle of Mr. Ronalds's method of recording magnetical and meteorological phænomena; whilst a few specimens of the actual work of these instruments served to show the degree of accuracy of which they were capable.

“Portions of an electrical apparatus were so arranged as to illustrate the methods of insulation and of observation employed in the larger atmospheric electrometer of Mr. Ronalds.

“A complete meteorological thermometer-stand, similar to the one actually in use at the Observatory (described in the Report of the Kew Committee to the meeting at Liverpool, 1854), was constructed under my own superintendence, and furnished with instruments chiefly graduated by myself.

“Some of the standard thermometers graduated at the Observatory have

been sent; and an apparatus similar to that employed here in the verification of thermometers has been constructed, and is exhibited in working order.

"The meteorological instruments made use of in the balloon ascents of 1852 were put in order, and arranged for exhibition exactly in the condition in which they were employed in the ascents.

"The following instruments were made by my direction expressly for the Exhibition :—

"An Evaporation-gauge on the principle of Mr. Ronalds.

"A common circular Rain-gauge.

"A portable Boiling-point apparatus (the thermometer graduated by myself), on the principle of Regnault's large instrument.

"At the request of the Committee, Mr. Adie furnished a specimen of the marine barometers constructed by him, and recommended by the Committee to the British and American Governments. Messrs. Negretti and Zambra, and Messrs. Casella and Co., also furnished specimens of the marine thermometers constructed by them under the superintendence of the Committee.

"In order to render the collection of meteorological instruments more complete, the Committee requested instruments to be sent by the following London opticians, viz.—

"By Mr. Newman, a Standard and a Portable Barometer.

"By Mr. Barrow, a Standard Barometer; and

"By Mr. Adie, a Standard and a Portable Barometer, and a Portable Robinson's Anemometer.

"The instruments having been prepared and collected at Kew, glass cases and other fittings required for their proper exhibition and protection were constructed, and the whole packed and forwarded on April 10th to the shipping agents appointed by the Board of Trade, by whom they were transmitted to Paris.

"Having learned that the instruments had arrived in Paris, and that the space allotted for their exhibition was in readiness; on May 9th, accompanied by Mr. Beckley, I proceeded to Paris for the purpose of arranging the Collection. Owing to certain arrangements of the Imperial Commissioners, I could not proceed with the necessary preparations until the 17th of May. On June 2nd, the instruments having been all put in order, we returned to the Observatory.

"The space assigned to the Kew Collection is situated near the middle of the South Gallery in the Central Building. It consists of a counter space 25 feet long, and an open space 25 feet long by 7 feet wide. On the counter are placed two glass cases, each 10 feet long, the one containing the smaller Magnetical Instruments, and the other the Meteorological Instruments. On the counter are also placed Mr. Ronalds's Self-registering Magnetograph, and the apparatus for the verification of thermometers.

"On the open space are placed the three large Magnetical Instruments used in the Colonial Magnetical Observatories, with the Reading Telescopes, supported by wooden Tripod Stands; the Self-recording Barometer and Electrical Insulator of Mr. Ronalds; and the Kew Thermometer Stand.

"There is also on this space a Stand containing a copy of the Magnetical and Meteorological Observations made at the British Colonial Observatories, surmounted by Mr. De la Rue's model of the Tower proposed to be erected at Kew for the Huyghenian Telescope.

"The various instruments, especially the magnetical, have been put, as far as was practicable, in a state of approximate adjustment. In order to avoid the effect of tremor in the floor, the magnets have been supported on blocks in such a way as to render the scales visible. All the instruments

have affixed to them descriptive labels in French and English. The annexed copy of these labels will best explain the nature of the collection.

“The instruments exhibited by the Kew Committee have been put in charge of M. de Fontaine Moreau, who has agreed to keep them in good order during the continuance of the Exhibition for the sum of £10. It would, I think, have been of great advantage if there had been, besides, some competent person appointed by the English Commissioners to take a general superintendence of the whole collection of Philosophical Instruments exhibited, and who, being always on the spot, could give any information required by visitors.

“You will see by the account of the expenses, which I have already handed to you, that there has been expended the sum of £141 4s. 7d., which already exceeds the amount of the grant from the Board of Trade. Some considerable expense will still be necessary for the protection of the Instruments in Paris, as well as for having them repacked and sent home at the close of the Exhibition. The amount of this I cannot at present estimate, but it will not I believe exceed £50.

“It will be borne in mind that these expenses do not include any return to the funds of the Observatory, on account of the loss of the services of their Assistants during the very considerable period which has been devoted to the preparation of the Instruments and their arrangement in Paris. This period has been little (if at all) short of three months, and the consequent pecuniary sacrifice by the Committee cannot be estimated at less than £60 or £70, independently of the very serious inconvenience sustained in the derangement of the general work of the Observatory.

“I am, dear Sir,

“Yours faithfully,

“J. WELSH.

“To J. P. Gassiot, Esq., F.R.S.,  
Chairman of the Kew Observatory Committee.

“*Copy of the Labels affixed to the various Instruments and Apparatus deposited by the Kew Observatory Committee in the Paris Universal Exhibition.*

“1. Declination Magnetometer employed in the British Colonial Magnetic Observatories, under the superintendence of Colonel Edward Sabine, R.A., F.R.S. &c. &c. Constructed by Grubb of Dublin, on the model of the instrument used in the Dublin Magnetic Observatory, under the direction of Dr. Lloyd, F.R.S.

“2. Bifilar Magnetometer, for observations of the variations of the horizontal magnetic intensity, employed in the British Colonial Observatories, under the superintendence of Colonel Edward Sabine, R.A., F.R.S. &c. &c. Constructed by Grubb of Dublin, on the model of the instrument used in the Dublin Magnetic Observatory, under the direction of Dr. Lloyd, F.R.S.

“3. Balance Magnetometer, for observation of the variations of the vertical magnetic intensity, employed in the British Colonial Magnetic Observatories, under the superintendence of Colonel Edward Sabine, R.A., F.R.S. Devised by Dr. Lloyd, F.R.S., and constructed by Robinson of London.

“4. Dip-circle with Microscopes, for observation of the magnetic inclination, furnished with Deflection Bars, for observation of the absolute vertical intensity, by the method of Dr. Lloyd. Constructed by Barrow and Co., London.

“5. Standard Compass used in the British Navy, with Sabine's Deflection Apparatus. Constructed by Barrow and Co., London.

"6. Portable Unifilar Magnetometer, for observation of deflection in the determination of the absolute horizontal intensity by the method of Gauss. Constructed by W. H. Jones of London.

"7. Portable Vibration Apparatus (to accompany the Unifilar Magnetometer), for observations of the time of vibration of the deflecting magnet in experiments for the absolute horizontal intensity, with brass rings for the determination of the moment of inertia of the magnet and its appendages. Constructed by W. H. Jones of London.

"8. Portable Declinometer, with Theodolite and Collimator Magnet, for observation of the absolute declination. Constructed by W. H. Jones of London.

"9. Universal Unifilar Magnetometer, for observations of deflection and vibration in experiments for the absolute horizontal intensity, and (with the addition of a Theodolite) of the absolute declination. Constructed by W. H. Jones of London.

"10. Portable Declinometer, for observations of the variations of the magnetic declination. Constructed by W. H. Jones of London.

"11. Portable Bifilar Magnetometer, for observations of the variations of the horizontal intensity. Constructed by W. H. Jones of London.

"12. Self-registering Magnetometer, for recording photographically the variations of the horizontal magnetic intensity, or of the magnetic declination. Invented by Francis Ronalds, Esq., F.R.S., and constructed under his direction for the Kew Observatory.

"13. Self-registering Barometer, for recording photographically the variations of the atmospheric pressure, with mechanical compensation for the effect of temperature. Invented by Francis Ronalds, Esq., F.R.S., and constructed under his direction for the Kew Observatory.

"14. Apparatus to illustrate the methods of Insulation and Observation employed in the Atmospheric Electrometer, constructed for the Kew Observatory, under the direction of Francis Ronalds, Esq., F.R.S.

"15. Thermometer Stand for Meteorological Observations, similar to that employed at the Kew Observatory; furnished with—

A. Dry- and Wet-bulb Thermometers.

B. Regnault's Condensing Hygrometer, with the Inverting Aspirator of Mr. Ronalds.

C. Daniell's Dew-point Hygrometer.

D. Negretti and Zambra's Maximum-Thermometer.

E. Phillips's Maximum-Thermometer.

F. Rutherford's Minimum-Thermometer.

"16. Standard Barometer by Newman.

"17. Standard Barometer by Barrow and Co.

"18. Standard Barometer by Adie.

"19. Portable Barometer by Newman.

"20. Portable Barometer by Adie.

"21. Marine Barometer by Adie, London, supplied to ships by the British and American Governments, on the recommendation of the Kew Observatory Committee.

"22. Cistern of Adie's Standard or Portable Barometer.

"23. Cistern of Newman's Portable Barometer.

"24. Standard Thermometers graduated at the Kew Observatory by J. Welsh.

"25. Thermometers for Marine Meteorological Observations, supplied to ships by the British and American Governments, on the recommendation of the Kew Observatory Committee.

“26. Evaporation-Gauge, invented by Francis Ronalds, F.R.S, and employed at the Kew Observatory.

“27. Rain-Gauge, with graduated Glass-measure.

“28. Portable Apparatus, for the determination of heights by observation of the boiling-point of water. Constructed on the principle of Regnault's Boiling-point Apparatus for the Kew Observatory.

“29. Meteorological Instruments employed in the experimental Balloon ascents performed in 1852, under the direction of the Kew Observatory Committee, at the expense of the Royal Society of London.

“30. Portable Robinson's Anemometer.

“31. Sliding-rule for the computation of the results of observations of the dry- and wet-bulb hygrometer. Designed by J. Welsh, of the Kew Observatory.

“32. Sliding-rule for computing the variations of the dip and total intensity from observations of the horizontal and vertical components of magnetic intensity. Designed by J. Welsh, of the Kew Observatory.

“33. Apparatus similar to that employed at the Kew Observatory, in the verification of the thermometers supplied to ships by the British and American Governments.

“34. Specimens of the Photographic Records of the Self-registering Magnetometer and Barometer, with apparatus for measuring the ordinates of the curves.”

The cost and expenses incurred in the preparation and transit of the instruments and apparatus sent to the Paris Exhibition having exceeded the amount of £140 received from the Board of Trade, and Mr. Welsh having strongly recommended that some arrangement should be made for increased inspection of the instruments and apparatus during the time they remain in the Exhibition,—

The Committee Resolved,—That the Chairman be requested to forward an account of the expenses incurred, amounting to £141 4s. 7d., with vouchers, to the Board of Trade, and a list of the instruments exhibited, requesting that a further sum of £50 be granted in order to defray the expenses that must be incurred in repacking and forwarding the instruments to England; and that a copy of the above, and of this Resolution, be sent to the Royal Society's Paris Exhibition Committee, requesting its support of the application.

A copy of the above Resolution, with a list of the apparatus deposited in the Exhibition, has been forwarded to Dr. Lyon Playfair and to the Royal Society.

The apparatus for testing barometers has been completed, and is now in action. This apparatus has been entirely constructed in the Observatory by Mr. Beckley, under the direction and superintendence of Mr. Welsh.

In their last report, the Committee stated that they had engaged to verify for the Board of Trade 400 thermometers and 60 barometers, and for the United States Navy 1000 thermometers and 50 barometers, all of which instruments have now been despatched from the Observatory. The Committee have since undertaken the verification of the following additional instruments, viz.

	For the Board of Trade.	For the Admiralty.
Thermometers . . . . .	400	480
Barometers . . . . .	60	80
Hydrometers . . . . .	600	400

Of which there have been already completed 540 thermometers, 800 hydro-

meters, 45 barometers. There have besides been verified for opticians 92 thermometers. The total number of instruments verified up to this time is 2032 thermometers, 155 barometers, 800 hydrometers.

The Chairman has received an application, through Colonel Sabine, from Dr. Pegado, Superintendent of the Royal Marine Meteorological Observatory at Lisbon, for a Kew Standard Thermometer, and for specimens of the Marine Barometers, Thermometers and Hydrometers, supplied to the British Navy and Board of Trade, accompanied by an inquiry whether a supply of such instruments can be obtained for the Portuguese Royal Marine by the aid of the Kew Committee of the British Association, the centesimal scale being employed in the thermometers, and the metrical scale in the barometers. The instruments thus applied for are in course of preparation, and the Kew Committee signified to Dr. Pegado their readiness to undertake the verification of Marine Meteorological Instruments for the Portuguese Government (if desired), under similar arrangements to those which have been approved and adopted by our own Government and by the Government of the United States.

The increased demand on the time and work necessary for the verification of instruments in the Observatory, renders it necessary for the Committee to employ further assistance. As yet the Committee have not been able to obtain the permanent services of any person of the character they require; but in the meantime, Dr. Hermann Halleur, of Berlin, at a weekly salary of 30s., on the recommendation of Colonel Sykes, has undertaken for a short time to assist Mr. Welsh in the verification of the instruments.

The Committee has caused a room for magnetic experiments to be erected in the ground, at a cost of about £50.

The apparatus suggested by Sir John Herschel for photographing the spots on the sun's disc, is progressing under the superintendence of Mr. Warren De la Rue. The Solar Photographic Telescope is promised by the maker complete in three months; the object-glass is finished, and some progress has been made with the stand. The diameter of the object-glass is 3·4 inches, and its focal length 50 inches; the image of the sun will be 0·465 inch, but the proposed eye-piece will, with a magnifying power of 25·8 times and focal length  $x$ , increase the image to 12 inches, the angle of the picture being about  $13^{\circ} 45'$ . The object-glass is under-corrected in such a manner as to produce the best practical coincidence of the chemical and visual foci\*. The eye-piece consists of two nearly achromatic combinations, their forms, foci, and focal lengths being arranged upon the basis of the photographic portrait lens, the conditions being nearly similar.

It is contemplated to form the system of micrometer-wires on a curved surface; and it may ultimately be found to be advantageous also to curve the photographic screen, as the small curvature necessary, namely about two-tenths of an inch, will present no mechanical difficulties. As in practice it may possibly be found desirable not to produce the sun's image with too great rapidity, a provision is contemplated for the absorption of some of the most energetic active rays by the interposition of coloured media of different tints.

The telescope being for a special object, it will have no appliances except such as appertain exclusively to that object, so that the only means provided for *viewing* the sun will be through the finder intended for facilitating the adjustment of the sun's image in position as regards the micrometer. The

\* Mr. Ross has found, that if for the greatest intensity of vision, in common lenses, the ratio of the dispersive powers of the two media is 0·65, the chemical and visual foci will coincide best practically when with the same media the ratio is altered to 0·60; the media he sometimes uses being Pellatt's flint and Thames plate.

polar axis will be furnished with a worm-wheel and clock-work driver, and the declination axis with a clamping circle. A shutter for covering the object-glass, and capable of being rapidly moved by the observer, will be so contrived as to be under his command, whether he be at the time near the object-glass or near the screen, eight feet distant.

It was originally intended to place the telescope in an observatory 12 feet in diameter, provided with a revolving roof; adjoining the observatory, a small room for chemicals was to have been constructed, so as to facilitate the fixing of the pictures. It has however been found possible to somewhat alter the construction of the tube, so as to reduce its length sufficiently to allow of the telescope being placed under the dome of the Kew Observatory, which is only 10 feet in diameter.

Dr. Miller has selected an air-pump for the use of the Observatory, which has been purchased out of the grant of the Royal Society, and is now in the Observatory.

Dr. Robinson's Anemometer, to record the total amount of wind (but not as yet the time or direction), has been constructed at the Observatory, and is now in action.

JOHN P. GASSIOT,  
*Chairman.*

*Special Report of the Kew Committee relative to the use of Land contiguous to the Observatory, as also to the Lighting of the Building with Gas.*

The Committee having ascertained through the Earl of Harrowby, President of the British Association, that in consequence of a recent Act of Parliament no portion of the ground contiguous to the Observatory could be obtained free of rent, and the Commissioners of Parks, Palaces, and Public Buildings having refused to light the Observatory with gas, the Committee consider it their duty to present the following special Report for the consideration of the Council.

*Report.*

The Observatory was originally placed at the disposal of the British Association by Her Majesty's Government in 1842, and has since been used as a place of deposit for the various books, papers and apparatus belonging to the Association, as well as for the carrying on a continued series of scientific investigations, which have from time to time been fully detailed in its annual reports.

In the Report of the Committee presented to the Association at their Meeting at Hull in September 1853, it was recommended that an application should be made to the Commissioners of Woods and Forests for the temporary use of a small portion of the ground near the Observatory for the erection of suitable places for observing: this recommendation having been approved by the Association, Col. Sabine and the Chairman of the Committee waited on Sir W. Molesworth in January 1854, and explained that the land which the Committee required would not exceed two acres. Sir W. Molesworth stated, that there was some doubt whether the Park was under the control of his Board, but that he would be happy to forward the application.

The Committee not hearing anything further from Sir W. Molesworth, applied to the Hon. Charles Gore, who, at their request, visited the Observatory on the 1st of April, 1854, in company with Mr. Clutton, when it was arranged that the Committee should pay a sum of £10 10s. per acre for the use of the land to the tenant, until Michaelmas 1854, at which time it was

stated the present tenure with the Crown would cease, and it being then considered, that at the termination of the agreement arrangements might be made with the Crown for the use of this small portion of the ground; this, however, is now found to be impracticable: the Commissioner having subsequently informed the Committee that he has no intention to determine the present tenancy of the Park, the Committee are therefore precluded from becoming the direct tenants from the Crown, even at a rental (see Letter, 11th April, 1855); and consequently they must either continue to pay the present exorbitant rent of £10 10s. per acre, or give up the land to the tenant, although an expense of £48 in fencing, and nearly £50 in the erection of a magnetical house, has been incurred.

In respect to the lighting of the Observatory with gas, the Committee consider that it is highly desirable that this should be effected; for, exclusive of the increase in the general scientific work carried on in the Observatory, the constant attention requisite in the verification of the barometers and thermometers for the use of H.M. Navy and the Mercantile Marine, renders a more perfect and uniform system of lighting highly desirable, as also avoiding the danger of fire by the use of oil lamps.

The Committee having at last ascertained, by correspondence, that the Observatory and the Park are under the control of separate Boards, the Observatory being under the direction of the Commissioners of Parks, Palaces, and Public Buildings, while the Park is under that of the Woods, Forests, and Land Revenues, applied to the Chief Commissioner of the latter department, to ascertain whether he would grant permission to lay down the gas-pipes in the Park, and whether any, and what, amount of compensation would have to be paid to the tenant who rents the land; by the correspondence it will be seen that no compensation will be required, if the gas-pipes are laid down during the winter, and that the Chief Commissioner will not object, provided the Association will undertake to pay a nominal rent of 1s. per annum.

The Committee have ascertained that the cost of laying down the gas to the Observatory would be about £220, and in the event of its being considered advisable, all that will now be necessary to obtain is the sanction of the officer of the Parks, Palaces, and Public Buildings department, who has charge of the district, and whose name and address the Committee will endeavour to ascertain.

JOHN P. GASSIOT,  
*Chairman.*

### *Supplementary Report of the Kew Committee, September 12, 1855.*

In addition to the report presented to the Council on June 27, a copy of which is appended, your Committee have now to report that a tube of rather more than one inch internal diameter having been satisfactorily filled with mercury by Mr. Welsh, the standard barometer has been now completed. A detailed account of the various experiments which have been made during the construction of this instrument will be prepared for publication.

The following statement shows the actual number of meteorological instruments verified at the Kew Observatory during the past year:—

	Thermometers.	Barometers.	Hydrometers.
For the United States Government . . . .	1000	50	
„ Admiralty and Board of Trade. . . .	1340	200	1269
„ Opticians . . . . .	180	7	
Total. . . .	2520	257	1269

Apparatus similar to that employed at the Kew Observatory for the verification of barometers and thermometers, has been ordered by the Board of Trade, for the observatory at Liverpool; it has been constructed by Mr. Adie, under the advice and direction of Mr. Welsh; the original patterns used in making the Kew apparatus having been lent for that purpose. The Committee have also been informed that it is the intention of the Admiralty to provide similar apparatus for Portsmouth and Plymouth.

The apparatus necessary for the complete registration of Dr. Robinson's Anemometer is in progress at the Observatory; the castings of all the parts and most of the wheel-work being completed.

The following letter having been addressed by Mr. Welsh to the Chairman, copies were forwarded, by the instructions of the Committee, to Admiral Beechey and Captain FitzRoy at the Board of Trade.

"Kew Observatory, Aug. 27, 1855.

"MY DEAR SIR,—I enclose a memorandum of the number of meteorological instruments which during the past years have been verified for the meteorological department of the Admiralty and Board of Trade, with the sums due to the Kew Committee for the same.

"In the event of further contracts being entered into with the opticians for the supply of meteorological instruments which are to be examined at this observatory, I would offer one or two suggestions with regard to the instruments and the terms of the contracts, with the view of facilitating our proceedings and of securing greater uniformity in the quality of the instruments, and greater punctuality in their delivery.

"1st. As regards the *accuracy* of the graduation of the thermometers, we have, I think, been fully successful; the instruments made by Casella and by Negretti and Zambra have in this respect been constructed with much care, and the numbers rejected on account of error very small. I have not, however, been so well satisfied with regard to the uniformity of the instruments in a mechanical point of view:—the diameter of the bulbs has been too irregular, and in many cases considerably more than is desirable,—the range of the graduation has differed in many instances excessively from that prescribed in the instructions of the Kew Committee,—and even the dimensions of the mere *material* have been too little attended to, at least in some of the instruments more recently made by Negretti and Zambra. With respect to the first two faults, as it is practically impossible to make the instruments *exactly* to a prescribed pattern, I would suggest that certain *limits* should be clearly specified in the contracts, beyond which the instruments must not be in error; for example, 'the diameter of the bulb should be as nearly as possible 0·4 inch, it must not exceed 0·5 inch, nor fall short of 0·3 inch,' and 'the graduation shall extend through  $8\frac{1}{2}$  inches of the tube, and shall range from about  $10^{\circ}$  to  $130^{\circ}$ , and shall not exceed the limits  $0^{\circ}$  to  $140^{\circ}$  or  $20^{\circ}$  to  $130^{\circ}$ .' The dimensions of the mere materials should of course be explicitly stated, and no deviation from them be allowed. In the instructions given at first by the Committee, it is stated that 'fluoric or hydrofluoric acid' may be used in etching the divisions: I would suggest that fluoric acid vapour alone should be used.

"2nd. In the case of the hydrometers, it would be well if there existed more uniformity in the form and dimensions of the instruments as made by the three different makers employed by Captain FitzRoy. Those made by Casella are, on the whole, the best adapted for practical work; their scales should, however, be more open. In shape and strength they are by far the best, those by Adie and by Negretti and Zambra being much too

fragile to stand the work they are designed for. In respect to accuracy, Casella's are also incomparably the best, and he deserves credit for the care with which they have been made: I cannot report so favourably of the quality of those by Adie, or Negretti and Zambra. I would recommend that for the future the use of metal hydrometers should be altogether discontinued. They are four times the price of glass ones,—are generally less accurate,—are more apt to give deceptive results from their greater affinity for grease,—are very liable to pick up small particles of mercury,—and, lastly, if they do get a knock, their indications are rendered *false*; whereas a glass one is simply destroyed and no harm is done to the observations.

"3rd. I have no particular remark to make about the marine barometers by Adie; they continue to improve in quality and regularity as the maker becomes more familiar with the work.

"4th. With regard to punctuality in the delivery of the instruments;—there is, I understand, in the contracts, a clause to the effect that if the instruments are not delivered at certain dates, the Board of Trade or Admiralty are at liberty to purchase the instruments elsewhere, the defaulter to pay any difference in the cost. Now such a penalty might do very well if we had to deal with articles which are to be had at any time of the same quality. As it is, the instruments are not to be had in an emergency by simply sending into the market. I do not mean that barometers and thermometers may not be had in abundance, but we know, from past experience, that they are not of a quality which it would be desirable to give out for accurate observations. Such a penalty becomes therefore practically inoperative. I would suggest, whether a direct pecuniary fine should not be rather imposed in cases of default. If the punctual delivery of the instruments by the makers were rigorously enforced, I should then be able so to arrange beforehand the work of the Observatory, that the verifications should in all cases be proceeded with promptly and regularly. The want of punctuality hitherto has frequently been a source of serious inconvenience to the Observatory.

"It would, I believe, contribute much to regularity, if the thermometers and hydrometers were sent here in the boxes, just as they are to be delivered to the ships: the additional expense would be very trifling,—perhaps a half-penny on each instrument.

"I remain, dear Sir, yours faithfully,

"*J. P. Gassiot, Esq., F.R.S.*"

"J. WELSH."

The following reply has been received from the Board of Trade:—

"Office of Committee of Privy Council for Trade, Marine Department,  
4th September, 1855.

"SIR,—I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your letter of the 31st ultimo, enclosing a copy of a letter from Mr. Welsh, having reference to certain arrangements which he proposes should be made with instrument-makers in the case of future contracts for meteorological instruments; I am to convey to you their Lordships' thanks for the communication, and to inform you that they will adopt Mr. Welsh's suggestions.

"I am, Sir, your obedient Servant,

"DOUGLAS GALTON, Capt. R.E."

"*John P. Gassiot, Esq., Chairman of the Kew Committee,  
British Association, Kew Observatory.*"

Two portable barometers by Adie, previously compared with the standard

at Kew, were deposited for a few days at the Imperial Observatory at Paris; comparisons with the standard instrument of the Observatory were taken by M. Liais, which indicated that the standards of the two Institutions do not differ from each other by one-thousandth of an inch.

In the report of the Committee presented to the Association at the Liverpool Meeting, it is stated that—"Considering the variety and importance of the objects which are now being carried out at the Observatory, the Committee submit for the consideration of the Council, that should the financial state of the Association at Liverpool justify an increase in the annual sum placed at the disposal of the Committee, they feel confident that a larger grant than has been allowed in the last few years for the maintenance of the Observatory, might be so appropriated in the next year with great advantage to the interests of science and to the credit of the Association." The Association responded to this request by placing the sum of £500 at the disposal of the Kew Committee. The Committee hope that the account of disbursements and the report now presented will satisfy the Association that the money expended during the past year has not been misapplied. Should the financial position of the Association justify the expenditure, the Committee hope that a similar amount of £500 may be awarded for the current expenses of the Kew Observatory for the ensuing year.

The Committee cannot close this report without alluding to the advantages which are likely to arise from the endeavours used by the Association to improve the construction of meteorological instruments, and at the same time to reduce their price. Independently of the improvement which the Committee have been able to introduce in the manufacture of instruments for the use of the Royal and Commercial Marine, they are gratified by perceiving an increasing disposition among the makers generally to bestow more care upon the construction of their instruments.

(Signed)

JOHN P. GASSIOT,  
*Chairman.*

#### CORRESPONDENCE REFERRED TO IN PRECEDING REPORT.

##### 1. *Mr. Gassiot to the Hon. Charles Gore.*

"Clapham Common, 20th March, 1855.

"SIR,—You are I believe aware, that some years since H.M. Government placed the Observatory in the Old Deer Park, at Richmond, at the disposal of the British Association, with the view of its being used not only for the deposit of the various scientific instruments and apparatus as well as books belonging to the Association, but also for the carrying on of various scientific experimental investigations.

"Much inconvenience has arisen in the prosecution of the latter, from the Observatory not being properly lighted, and I have been requested by the Committee to suggest to you the advisability of the interior of the building being lighted with gas.

"Exclusive of the desirableness of the gas being laid on, as has been done in the Magnetical and Electrical Department of the Royal Observatory at Greenwich Park, and in the event of which the Committee would be enabled to carry out a variety of scientific investigations which they are now totally prevented from commencing, I may state that the increased requirements arising from the number of barometers and thermometers, which are at present in course of verification for the use of H.M. Navy and Mercantile Marine, has rendered it indispensable that a corresponding

increase should be made in the number of oil lamps, and the Committee cannot but be sensible that in a building in which so large a quantity of papers and books is distributed, a corresponding increase in the danger of fire has arisen; this would be entirely obviated by the introduction of gas into the building.

“Limited as are the funds which are at the disposal of the Association, the expense of the gas proposed to be used would be defrayed by the Committee, and all they ask is that it should be laid on in the different rooms. The Committee hope that as no pecuniary assistance is received by the Association from H.M. Government, and that as the exertions of the Committee have latterly been devoted to the great national object of verifying the meteorological instruments used by H.M. Navy, this request will not be refused.

“Some time since, the Committee made arrangements through your Surveyor, with the present tenant, for the occupation of two acres of the land immediately contiguous to the Observatory; the land has been enclosed with a strong paling at a very considerable expense.

“In any future letting, the Committee hope they will be permitted to take the two acres direct from the Crown, at such rent as your Surveyor may consider fair and equitable; and as some misunderstanding has at times arisen as to the right of way to the Observatory, the Committee would feel obliged in any future arrangements you may make for the letting of the land, that the right of way should be specified.

“I am also directed to acquaint you, that the Committee consider it desirable the Building should be examined by your Surveyor, as some repairs are required, which if not made at an early period, may ultimately cause considerable expense to the Government.

“I have the honour to be, Sir,

“Your obedient Servant,

(Signed)

“J. P. GASSIOT.”

“To the Hon. Charles Gore.”

### 2. *Mr. Gore to Mr. Gassiot.*

“Office of Woods, &c., 27th March, 1855.

“SIR,—I have to acknowledge the receipt of your letter of the 20th inst., and to inform you in reply, that the Buildings of the Observatory being under the charge of the Commissioners of Her Majesty’s Works, &c., any communication respecting its condition, or as to lighting it with gas, should be made to that Department at No. 12 Whitehall Place, and I have therefore transmitted copy of those portions of your letter which have reference to that Building to that Office.

“With respect, however, to the tenancy of the land adjoining the Observatory, I have to state that in the event of any change in the letting of the Park taking place, your application, that the Committee of the British Association may be permitted to rent it direct from the Crown, and a right of way thereto reserved in the letting of the residue, shall receive attention.

“I am, Sir,

“Your obedient Servant,

(Signed)

“CHAS. GORE.”

“J. P. Gassiot, Esq.”

### 3. *Mr. Gore to Mr. Gassiot.*

“Office of Woods, &c., 11th April, 1855.

“SIR,—With reference to my letter to you of the 27th ult., I have to acquaint you that I do not think it would be for the interest of the Crown,

and I have therefore no intention to determine the present tenancy of the Old Deer Park. It is not therefore in my power to give to the British Association a direct holding under the Crown of the land adjoining the Observatory and in their occupation; but, as stated in my said letter, in the event of any change in the letting taking place, your application to that effect shall receive attention.

“I am, Sir,

“Your obedient Servant,

(Signed)

“CHAS. GORE.”

“J. P. Gassiot, Esq.”

#### 4. *Mr. Gassiot to the Hon. Charles Gore.*

“Clapham Common, 17th April, 1855.

“SIR,—I have the honour to acknowledge receipt of your esteemed favours of 27th ult. and 11th inst. At the time the Committee agreed to give the present tenant the rent which they now pay, they considered (from the conversation they had with you) that the present tenancy terminated next Michaelmas, otherwise they would not have instructed me to make the application, and they cannot but regret it is not in your power to give them a direct holding under the Crown for the small portion of the Park which they at present occupy.

“In your letter of 27th ult., you stated that you had forwarded an extract of that portion of my former letter which referred to the repairs and lighting of the Observatory with gas to another department; I have not received any communication on the subject, and Mr. Welsh informs me that the Observatory has not been visited by any person in reference thereto; for the reasons mentioned in my letter, the Committee would feel obliged if you could assist them in obtaining the lighting of the Observatory with gas; as regards the repairs, unless some early notice is taken, the ultimate expense to Government may be considerable.

“I have the honour to be, Sir,

“Your obedient Servant,

(Signed)

“JOHN P. GASSIOT,

“*Chairman of the Kew Committee  
of the British Association.*”

“To the Hon. Chas. Gore.”

#### 5. *Mr. Gore to Mr. Gassiot.*

“Office of Woods, &c., 19th April, 1855.

“SIR,—I have to acknowledge the receipt of your letter of 17th inst., requesting attention to your previous application, with regard to the repairs and lighting of the Observatory in the Old Deer Park with gas.

“In reply I have to acquaint you that I have no power to obtain a reply, and to suggest therefore that any further communication on the subject which you may consider desirable, should be addressed direct to the Chief Commissioner of Her Majesty’s Works, &c., No. 12 Whitehall Place, to whom, as stated in my letter of the 27th ult., I had forwarded your previous application.

“I am, Sir,

“Your obedient Servant,

(Signed)

“CHAS. GORE.”

“J. P. Gassiot, Esq.”

6. *Mr. Gassiot to the Hon. Sir William Molesworth, Bart.*

“Clapham Common, 26th May, 1855.

“SIR,—On the 20th of last March, by the direction of the Kew Committee of the British Association, I addressed a letter to the Hon. Charles Gore, Chief Commissioner of H.M. Woods, Forests, and Land Revenue Department, of which the following are extracts:—

“‘You are, I believe, aware, that some years since H.M. Government placed the Observatory, in the Old Deer Park at Richmond, at the disposal of the British Association, with the view of its being used not only for the deposit of the various scientific instruments and apparatus, as well as books belonging to the Association, but also for the carrying on of various scientific experimental investigations.

“‘Much inconvenience has arisen in the prosecution of the latter, from the Observatory not being properly lighted, and I have been requested by the Committee to suggest to you the advisability of the interior of the Building being lighted with gas.

“‘Exclusive of the desirableness of the gas being laid on, as has been done in the Magnetic and Electrical Department of the Royal Observatory at Greenwich Park, and in the event of which the Committee would be enabled to carry out a variety of scientific investigations which they are now totally prevented from commencing, I may state that the increased requirements arising from the number of Barometers and Thermometers which are at present in course of verification for the use of H.M. Navy and Mercantile Marine, has rendered it indispensable that a corresponding increase should be made in the number of oil lamps, and the Committee cannot but be sensible that in a Building in which so large a quantity of papers and books is distributed, a corresponding increase in the danger of fire has arisen; this would be entirely obviated by the introduction of gas into the Building.

“‘Limited as are the funds which are at the disposal of the Association, the expense of the gas proposed to be used would be defrayed by the Committee, and all they ask is that it should be laid on in the different rooms; the Committee hope that as no pecuniary assistance is received by the Association from H.M. Government, and that as the exertions of the Committee have latterly been devoted to the great national object of verifying the meteorological instruments used by H.M. Navy, this request will not be refused.

“‘I am also directed to acquaint you, that the Committee consider it desirable the building should be examined by your Surveyor, as some repairs are required, which if not made at an early period, may ultimately cause considerable expense to the Government.’

“‘On the 27th March, Mr. Gore replied, stating ‘that the Building of the Observatory being under the charge of the Commissioners of Her Majesty’s Works, any communication respecting its condition, or as to lighting it with gas, should be made to that department, at No. 12, Whitehall Place, and I have therefore transmitted copy of those portions of your letter which have reference to that Building to that Office.’

“‘Nearly two months having elapsed without being favoured with any communication from you, I have been directed by the Committee to state, that they should feel obliged by your informing them whether their request can be complied with: I may add, that, in respect to the repairs, these are absolutely necessary, in order to prevent a much larger outlay at no great distance of time.

“I have the honour to be, Sir,

“Your obedient Servant,

“JOHN P. GASSIOT.”

(Signed)

7. *The Secretary of the Board of Works, &c. to Mr. Gassiot.*

“Office of Works, &c., June 2, 1855.

“SIR,—The Commissioners of Her Majesty’s Works, &c. have had transmitted to them by the Hon. Charles Gore, one of the Commissioners of Her Majesty’s Woods, &c., extracts from your letter to him of the 20th March last, in which you request, on behalf of the British Association, that they may be permitted to burn gas in the Observatory in the Old Deer Park at Richmond, the use of which has been allowed to them, and also that the gas may be laid on to the different rooms free of expense to the Association, their engaging to pay the cost of the gas proposed to be used.

“In reply, I am directed to inform you that the Board have no objection to the use of gas in the building in question, but that the whole of the work must be done by, and at the expense of, the Association, and to the satisfaction of the Board’s officer in charge of the district.

“I am, Sir,

“Your most obedient Servant,

(Signed)

“J. THOMBORROW,  
“Assistant Secretary.”

“J. P. Gassiot, Esq.”

8. *Mr. Gassiot to the Secretary of the Board of Works, &c.*

“Observatory, Old Deer Park, Richmond,  
June 7, 1855.

“SIR,—I beg to acknowledge the receipt of your letter of the 2nd instant, wherein you state that, in reply to a communication made by me to the Hon. Charles Gore on the 20th of last March, relative to the lighting of the Observatory with gas, the Board has no objection to the use of gas in the Observatory, but that the whole of the work must be done at the expense of the British Association, and to the satisfaction of the Board’s officer in charge of the district.

“In a letter addressed to the Right Hon. the Chief Commissioner, of the 26th ult., but which you have not done me the honour to notice, I explained that, in consequence of the increased requirements arising from the number of barometers and thermometers which are at present in course of verification for the use of Her Majesty’s Navy and the Mercantile Marine, it was highly desirable that the Observatory should be lighted with gas.

“The entire outlay attending the important work done in the Observatory has been defrayed by the British Association; and considering that so large a portion consists in the verification of instruments for the use of the Navy, I cannot but regret that so trifling a request should have been so summarily refused; for although upwards of two months have elapsed since the application was made, no one has visited the Observatory from your department to inquire as to the advisability of the application being granted.

“I believe I am also correct in stating, that during the many years the Observatory has been occupied by the Association, no officer from your Board has visited the building. I name this because a portion of my letter referred to its present dilapidated condition, to which the Committee had particularly requested me to draw the attention of your Board.

“I have the honour to be, Sir,

“Your obedient Servant,  
(Signed)

“J. P. GASSIOT.”

“J. Thomborrow, Esq.,  
Assistant Secretary, Parks, Palaces, &c.”

9. *Mr. Gassiot to the Hon. Charles Gore, Esq.*

"Kew Observatory, June 12, 1855.

"SIR,—The Chief Commissioner of Her Majesty's Works not having favoured the Kew Committee with any communication relative to their application to you for the introduction of gas into the Observatory, and which application you informed me, in your letter of the 27th of last March, you had forwarded to him, I addressed a letter to Sir William Molesworth on the 26th ult.; on the 2nd inst. the Assistant Secretary writes me as follows:—

"I am directed to inform you that the Board have no objection to the use of gas in the building in question, but that the whole of the work must be done by, and at the expense of, the British Association, and to the satisfaction of the Board's officer in charge of the district."

"The correspondence has been submitted to the Kew Committee, and I am instructed to inquire if you will grant permission for the gas to be laid on to the Observatory through the Park, and whether, in the case of your granting such permission, any, and if so, what amount of compensation will have to be paid to the tenant in possession.

"The Committee are anxious, before they present their Report to the Council of the Association, to be informed as to the total expense they would have to incur in laying on the gas; and as, in a former instance, compensation was to have been paid for the carrying of materials across the Park, the Committee considered it advisable that this should be ascertained before any outlay is commenced.

"I have the honour to be, Sir,

"Your obedient Servant,

(Signed)

"J. P. GASSIOT."

"To the Hon. C. Gore, Chief Commissioner  
of Her Majesty's Woods and Forests, Land Revenue."

10. *Mr. Gore to Mr. Gassiot.*

"Office of Woods, &amp;c., June 18, 1855.

"SIR,—In reply to your letter of the 12th instant, I have to inform you, that, provided the gas pipes are laid down as nearly as possible in the direction of the footpath leading from Mr. Fuller's Farm Premises to the Observatory in the Old Deer Park, as requested by you on behalf of the Kew Committee, I am ready to grant the permission sought on payment of an annual acknowledgment of one shilling.

"As regards the compensation to be made to the tenant of the Park, I am informed that if the works are not proceeded with until October next, and completed without interruption, and to the satisfaction of Mr. Clutton, the Crown Receiver, he will not require any compensation; and as Mr. Clutton has been informed by the Superintendent of the Observatory that the pipes will not be required to be laid down until the latter part of the year, I presume that the Committee will not object to accede to this arrangement.

"I am, Sir,

"Your obedient Servant,

(Signed)

"CHARLES GORE."

"J. P. Gassiot, Esq."

*Accounts of the New Committee of the British Association from Sept. 18, 1854 till Sept. 12, 1855.*

RECEIPTS.

	£	s	d.
Balance from last account .....	24	13	1½
Received from the General Treasurer .....	500	0	0
" from the Government Grant, for thermo- meter cases supplied .....	1	16	0
" for the verification of Instruments—£ s. d.			
from H.M. Government.....	7	10	0
from East India Company.....	15	14	0
from United States Government	75	0	0
from Opticians .....	2	16	0
	<u>101</u>	<u>0</u>	<u>0</u>

£627 9 1½

PAYMENTS.

	£	s.	d.	£	s.	d.
Salaries, &c. :—						
To Mr. Welsh, one year .....	150	0	0			
Ditto, allowed for petty travelling } expenses .....	10	0	0			
Ditto, for expenses in the trials of } marine barometers (omitted in } last year's account) .....	11	0	0			
Dr. Halleur, from Mar. 29 to Sept. 13...	36	0	0			
Ditto, Gratuity.....	10	0	0			
R. Beckley, from Sept. 18, 1854 till } Sept. 10, 1855, less nine weeks } paid from the Government } Grant .....	73	10	0			
J. V. Magrath, one year .....	40	0	0			

Apparatus, Materials, Tools, &c. ....	330	10	0
House Expenses, Coals, Chandlery, &c. ....	43	16	6
Ironmonger .....	43	7	2½
Carpenter .....	15	0	7
Building of Magnetic House .....	22	11	7
Stationery, Books, Printing, Postage.....	49	0	0
Porterage and petty expenses.....	21	14	9
Balance on hand .....	5	6	11
	<u>96</u>	<u>1</u>	<u>7</u>

£627 9 1½