REPORT

OF THE

TWENTIETH MEETING

OF THE

BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE;

HELD AT EDINBURGH IN JULY AND AUGUST 1850.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1851.

laya chain, giving rise to the Ganges and to the Bramapûtra river, and which are denominated Bhûtia. Of these Dr. Bird remarks, the connexion of this race with the Nomadic Tartar tribes possessing the central region of Upper Asia may perhaps account for that mixture of Sabeism which prevails in the religious worship of the Gonds, and is characteristic of the superstitious system of belief existing among the Mongolian tribes. Mr. Bradley, who has taken some pains on this subject, traces also a close connexion between the language of the Gonds and that of the Burmas, called by Mr. Marsden *Oraug benouas*, signifying literally the aborigines of the Malayan or Malacca peninsula.

The result of all my inquiries on the several aboriginal tribes of India leads me to the following conclusions:—First, that they are of a stock essentially differing in almost every character of a race from the Caucasian Hindu. That the whole have a common origin; and though they may have come, as they probably did at different times, both from the east and from the north, they are all derived from the same great Tartar horde, and undoubtedly inhabited India anterior to the invasion of that ancient and venerable people the Hindûs. The latter, proceeding eastward from Persia, extended over the barbarous nations of India, and introduced their laws, their civil institutions, and their language, at the same time enslaving the aborigines wherever they settled. The exclusive rules of caste forbade the intermixture of the two races, and this circumstance alone suffices to account for the separation having continued to exist for so lengthened a period.

While the Hindu branch of the Caucasian family proceeded eastward, other portions of the same race spread themselves westward and became the progenitors of the present European race. They subjected those they subdued to the yoke of slavery as serfs of the soil; they brought with them the Sanscrit or Indo-Germanic tongue, and to them Europe owes the introduction of that system of municipal administration which is the only true foundation of free institutions and constitutional government.

Report concerning the Observatory of the British Association at Kew, from September 12, 1849 *to July* 31, 1850. *By* FRANCIS RONALDS, *Esq., F.R.S., Honorary Superintendent.*

AT the conclusion of my last Report (for 1848–49), various proposals were made for the prosecution of new experiments and observations, and for the continuance of others already instituted at Kew: and the General Committee of the British Association, at the Birmingham meeting in September 1849, resolved that "Sir John Herschel having reported that the Meteorological Observations made at Kew are peculiarly valuable, and likely to produce the most important results, the sum of £250 be voted for the continuance of that establishment for the ensuing year," &c.*

Endeavours have accordingly been made, not only to cause this sum, added to about £50, the residue of the former year's grant, to go as far as possible toward the attainment of the principal objects contemplated, but, *at the same time*, to promote the views of Her Majesty's Government in the establishment of a convenient and *exact* system of self-registering magnetical and other meteorological instruments in the colonial observatories under the superintendence of our highly distinguished Honorary Secretary Colonel Sabine.

* *Vide* Report for 1849, p. xx. The *observations* here alluded to were principally those on atmospheric electricity.

It would be seen (on reference to some of the following details) that several of the proposed experiments have resulted in the construction of a new magnetograph; in considerable improvements upon others; in an improvement upon the barometrograph; in a convenient method of producing engraved copies of photographic curves, &c., procured by the self-registering instruments; in a few minor contrivances, &c. of other kinds; and finally, in an *attempt* to institute a series of observations on the frequency of atmospheric electricity, intended as preliminary to the formation of a system, and an apparatus which should permit the self-registration of this species of observations.

In the Kew Report for 1843–44, p. 141, are tabulated a very few of my observations on the subject of frequency made at Kew in that year; and the apparatus then employed, consisting of *two* atmospheric conductors, is shortly described. I believe that they were the first experiments of the kind which have been published since Beccaria's extremely interesting observations at Turin about 1750 (which were effected by means of apparatus having very imperfect insulating power), and I think that the above-named apparatus, of two conductors, &c., is somewhat better suited to the purpose than one rod which I now employ; but the funds and *localities* at Kew do not at present permit the use of the former. These few experiments, however, taken in conjunction with Beccaria's, with my own *old* experiments (at Highbury Terrace, and at Hammersmith, Upper Mall, not published), and with what little has been done at Kew this year, have tended to increase in my estimation the importance of carrying out such researches effectively. Their results may form a link in the chain of phænomena connecting the static with the dynamic electricity of the atmosphere; for it is only when frequency is great that *galvanometers* manifest a current. *If* atmospheric electricity exerts *any* agency on animal life, &c., is it not this condition (of frequency) which has prime influence?

These considerations, joined to the circumstance of frequency having been already in some measure a subject of inquiry at the Royal Greenwich, and even at the Bombay Observatories (with apparatus of the kind which I use), naturally create very great regret that the indisposition of the observer who was engaged at Kew during a part of this year, caused the series of observations on frequency to be so limited as it will be found to have been.

We shall, I trust, fully compensate for the deficiency under Mr. Welsh's able exertions next year.

I now proceed, as usual, to matters regarding—first, the Building, Instruments, &c., of the Observatory; secondly, to some remarks concerning observations; and thirdly, to an account of what has been done in the way of experiment since the last general meeting of the Association.

I. The Building, Instruments, &c.

The exterior of the premises has required very little repair. The addition of a rail, &c. has been made to the former arrangements on the Dome for the greater security and convenience of the observer whilst attaching the lantern to the top of the principal conductor.

In the interior, some painting, plastering, papering, &c. have been executed (in the basement). A few book-shelves have been added to those in the North Hall, for the reception of books presented to the Association, and for the stock of the Association's Reports, &c.

A small upper apartment has been appropriated to the mechanic or photographist as a sleeping-room.

The South Upper Room (or laboratory) has been supplied with a good lathe, turning tools, various chucks and necessary appendages; also with a vice-bench, &c., in order to render it efficient for experimental purposes, and to avoid the great delay and expense occasioned by having to send to London for many articles which can be constructed here.

The *Principal Conductor* on, and in, the Dome is in an efficient state, but should be dismounted and cleansed, &c. The slight inclination spoken of in my last Report has been remedied.

The *Volta-Electrometers* in the Dome have been repaired.

The *Galvanometer* (Goujon's) appears to have lost a little in sensibility, the needles being no longer perfectly astatic.

The *Discharger*, the *Gold-leaf Electroscope*, the *Distinguisher*, and the three *Night-registering Electrometers* are effective.

The pair of *portable Volta Electrometers*, and the *Peltier's* or rather *Erman's Electrometer*, are in working order.

The *Electrograph* (at the central window of the upper south room) has been somewhat damaged by a violent storm. It is intended to repair it, remove it to the dome, and connect it with the principal conductor there after the preliminary observations on frequency have been accomplished.

The *Wind-Vane* has been restored.

The *Rain and Vapour-Gauge*, and the *Balance Anemometer*, have been properly examined and adjusted at the requisite intervals.

The *Standard Thermometer*, and the *Wet-Bulb Hygrometer*, have been removed from their position at the north window of the Quadrant Room, and mounted on a thermometer stand.

The *Ordinary Barometer* has been (again) compared with the Royal Society's Instrument.

The *Kreil's Barometrograph* has been repaired, and a few curves have been drawn by it.

The *Photo-Barometrograph* has been removed from the Transit Room to the Quadrant Room, and has had a little alteration made in it for the purpose of rendering it applicable to either the Daguerreotype or the Talbotype processes. It still requires further alterations and improvements.

The *Declination Magnetograph* (in the Transit Room), described in the Phil. Trans. part 1 for 1847, has had some alterations made in it similar to those made in the Photo-Barometrograph.

A *Horizontal-Force Magnetograph* has been added to our collection, from apparatus sent from Woolwich, with my photographic self-registering arrangements. This instrument is in most respects similar to that described in my last Report, and sent to Toronto; the differences will be alluded to and easily understood when the experiments, &c. for the construction of the vertical-force instrument sent to Toronto are described below.

Also some apparatus of an improved kind, used in the *Daguerreotype process*.

An instrument for dividing right lines (necessary for the scales, &c. of all self-registering instruments), and a new kind of compasses or dividers, will be described under the head of "Experiments," as they are not yet considered to be complete.

The *Storm-clock* is in proper working order, and greatly facilitates observations on frequency. [As it is applicable extensively to meteorological, and even some astronomical observations, it should perhaps have the more general appellation of "*Observer's Clock*."]

The description of this instrument in our Journal for 1844–45 not having been printed, the following short account of it may not perhaps be deemed unnecessary:—

A (in Plate III. fig. 1) is a strong deal table firmly secured upon the stage in the Electrical Observatory. B is an inclined writing-board solidly attached

Mr. Ronald's Report.—To face p. 179.

FREQUENCY PAPER.—No. 1.

May 12. 17^h 17^m P 65·0

•

• 12·5

• 17·5 P

• 25

• 27·5

• 30

• 35

• 37·5

• 42·5

• 45

• 47·5

• 50

• 55

• 57·5

• 62·5

• 65

to A, and C is the clock-case. d^1 is the long pendulum within C, and d^2 its very heavy bob. d^3 is a lever which enters C through a slit, and whose fulcrum is at d^4: a spring (not shown) forces the nearest end of d^3 upwards when it is not stopped in the horizontal position. d^5 is a little stop fixed upon d^3. d^6 is a rod attached, by a pivot, through a slit to d^3, and passing through a hole in a piece of wood (not shown) attached to A. This part of the instrument is so constructed, that when the clock is not in motion d^5 is in a higher position than that shown, and the extremity of the then inclined pendulum d^1 is placed by the observer against its nearest side, preventing vibration; but when it is to be set in motion, d^5 is brought into the position shown by depressing the handle at the top of d^6. d^7 is a gut-line proceeding from the barrel of the clock contained in C, passing over B, round a pulley at an angle of A, and sustaining a weight, d^8, which gives motion to the clock-work. d^9 is another line sustaining the winding-up weight, d^{10}, which line passes round another pulley (unseen) under B, and entering C is attached to and winds round the barrel of the clock in the contrary direction to d^7.

The continuity of d^7 is interrupted by a small steel wire, upon which turns, or hangs freely, a little pointed brass plate d^{14}, pressing very lightly on B.

When the clock is at rest d^{14} is adjusted to the upper part of a "*Frequency Paper*" fixed (by drawing pins) upon B, and the whole is ready for use. When an observation is to be commenced, the time (by our chronometer) is written exactly opposite to the point of the index d^{14} (which has been placed at the top of the paper by pulling down the weight d^{10}); the conductor is then discharged, and the pendulum started (by pressing down d^6) at the same moment.

As the charge of the conductor advances towards its former intensity (or any other approximative maximum intensity), marks are made opposite to the index from time to time at convenient intervals; and the various tensions are noted down at those intervals near the marks until a maximum has been arrived at by estimation (*i. e.* when no increase of tension *seems* to be going on, or when a decrease has actually begun). The observation now ceases, and the fiducial edge of a scale, accurately divided into spaces corresponding with the rate of our chronometer, is applied to the above-mentioned first and last marks or "*notes of tension*," and occasionally to other of the marks. Or, in order to estimate as accurately as possible by these means the time of a maximum, the observation is carried on even beyond the apparent first maximum.

A copy of one of the "Frequency Papers" is annexed which has been employed for procuring the "Frequency Observation of Atmospheric Electricity," where it may be seen that on May 12th, $17^h\ 17'$, the charge of the conductor was positive and $=65$ divisions of the Electrometer, and that the Frequency (at about 11 minutes afterwards) was $=11'\ 15''$ (the charge had increased to 67·5 divisions).

The remaining apparatus and instruments of various kinds belonging to the Association, or on loan to it, do not seem to require particular notice here. They are carefully preserved.

II. Observations.

The only observations (or experiments) worth notice here, on the frequency of atmospheric electricity which have been made at Kew this year (by means of apparatus particularly described in the Society's Reports for 1843–44), commenced on the 12th of May and terminated on the 1st of June. The plan of procedure adopted was intended as merely preliminary, and in order to arrive at certain data for choosing the preferable mode of instituting a regular series of such observations (self-registering or ordinary).

The instructions given to the observer were as follow:—

"The pillar lamp, and the lamp of the lantern belonging to the electrical apparatus in the Electrical Observatory having been filled with good olive oil, and provided with wicks of the usual uniform size, which have not been used more than three or four days, to be at sunrise of every day, excepting Sundays and Wednesdays, lighted and placed in their usual positions for observations.

" At one hour after sunrise, or as near to that time as possible, an observation of the barometer, its attached thermometer, the standard thermometer, the wet-bulb hygrometer, the balance anemometer, and the wind-vane, together with remarks on the state of the sky, to be made and entered in the appropriate columns and page of the printed form headed 'Electro-Meteorological Observations,' &c., noting also the time of these observations, &c. having been commenced.

" As soon as possible after these entries have been effected, a note of the *kind and tension* of electricity to be made and recorded, with the time, on a paper, called a '*Frequency Paper*,' and immediately afterwards the principal conductor to be discharged suddenly and allowed to assume a new charge.

" A series of *notes of tension*, with the times, to be then commenced for the purpose of ascertaining (as nearly as the conditions below stated and other circumstances will permit) the length of time which may elapse between the moment of allowing the new charge to commence and the moment of that new charge arriving at a maximum tension. These notes of tension and times to be also set down upon the above-named frequency paper (or papers), together with any variation in the kind (positive or negative) of charge which may have occurred.

" The primary observation of kind and tension to be copied into the columns headed 'kind' and 'periodical observations' respectively; and the length of time which may elapse (as above) for obtaining a maximum tension, in the column headed 'frequency' of the above-mentioned printed form or journal.

" If a maximum tension should occur at any time after the expiration of half an hour, and within one hour, from the moment of allowing the above-mentioned new charge to commence, then fresh observations of the barometer and of the above-named other meteorological instruments, with remarks on the state of the sky, to be made as nearly as possible at the time of the maximum. This second set of observations of the barometer, &c. to be also entered in the printed form as before, with the times of these observations having been commenced.

" If a maximum tension should not occur before the lapse of one hour after the moment of allowing the above-mentioned new charge to commence, the series of notes of tension (which serve for endeavouring to attain the frequency observation correctly) to be discontinued; and the circumstance to be noted in the 'frequency paper' and the printed form as above.

" The lamps of the electrical apparatus to be kept burning and ready for observations from the time of being lighted until one hour after sunset. The charcoal stove (Joyce's) to be lighted and kept burning whenever the hygrometer indicates a damp state of the atmosphere, in order to preserve a sufficient insulating power in the distinguisher, &c.

" At one hour after meridian, or as near to that time as possible, and at sunset, the frequency observation, accompanied by observations of the barometer and other above-mentioned meteorological instruments, and remarks on the state of the sky, to be repeated. An observation of the rain and vapour-gauge to be also made at sunset (only), and the whole to be entered as before. The rain and vapour-gauge to be set at or near to this time.

" The frequency papers, the electro-meteorological journal, and the chronometer, to be kept usually on a table at the south end of the Transit Room.

"The mode of procedure here spoken of is chiefly applicable to serene weather, including fogs, mists, &c. If rain or snow, impending or more distant clouds, or sudden changes from a positive to a negative state of charge should occasion difficulties or impossibilities of observing frequency, these circumstances to be noted in the electro-meteorological journal and frequency paper."

III. Experiments.

The first subject of consideration, as respects instrumental experiments, after the last annual meeting, was a better mode of mounting the standard thermometer and wet-bulb hygrometer.

In October, a revolving stand, on the Greenwich plan, was erected at the north entrance of the building; but objections exist to this, and in fact to all "thermometer-stands" hitherto invented. Either the sun or the wind has injurious influences, which it should seem are hardly to be got rid of. I trust, however, the method will be improved under the suggestions of Col. Sykes.

In November 1849 some work and preparations were executed here for the vertical-force magnetograph (*vide* Plates I. & II.), alluded to in my last Report as being in an advanced state for the Toronto Observatory. In December some principal parts of it arrived from Mr. Ross and Mr. Newman, and its completion was proceeded with.

A successful attempt to improve this sort of apparatus was that of fitting a sliding plate to the frame containing the Daguerreotype plate, in such manner that it completely excluded light from the latter, whilst it was not in its place in the instrument, but allowed the focus to act upon it when properly placed there. This contrivance (a modification of one commonly practised by photographists) precludes entirely the necessity of operating upon the plate or paper in a dark room before the mercurializing part of the operation is performed.

An improvement in the mouth-piece permits a much greater facility and accuracy of adjustment in the breadth of the slit than had been before attained, a matter of some importance, when the delicate and rapid changes of the magnet's position are required to be registered. A chain was substituted for a gut-line for suspending the sliding-frame, which somewhat improves the accuracy of the magnetic curve produced on the contained metallic plate or paper. A little frame, containing ground glass, was added, in order to save time and trouble in examining the image of the slit in the shield. A screen, placed temporarily in the place of the fixed shield, was used with advantage for dividing the aberration of the lenses between the central and the outer parts of the range of the said image. This screen was provided with a series of slits, in lieu of the one slit only of the fixed usual shield. An improvement applicable to this and all photo-registering instruments of similar construction was adopted, consisting in a sliding shutter, which, by a simple, small, rotatory movement, given by the fingers to an arbor passing through the clock-plates, is opened in order to expose the Daguerreotype plate to the focus of light, and at the same moment to set the clock in motion, and *vice versâ*.

In order that the new arrangements may be clearly comprehended, and trouble saved in recurring to former descriptions, it will be convenient to place the whole apparatus before the eye as finally constructed.

Description of the Vertical-Force Magnetograph.

Similar letters refer to similar or analogous parts in the figures of this instrument, as well as of the horizontal-force magnetograph described at page 80 of the British Association's Report for 1849.

The figures 1 and 2 of Plate I. are drawn to one-eighth of the real size; figures 3, 4, 5 and 6, to one-fourth of the size. The figures of Plate II. to one-quarter of the real size.

V, figs. 1 and 2, Plate II., is the magnet box (in section), of mahogany, not coated, as before, with gold paper, provided with a squared tube, T, of cast brass, which opens into A.

A is the camera box (of mahogany).

a^1 is the usual solid brass casting, forming (in part) one of the ends of A.

B is a fifteen-inch magnet belonging to a vertical-force balance magnetometer of Dr. Lloyd's construction.

b^2, a piece screwed upon the upper edge of B.

b^3, a pair of very light, sliding brass tubes attached to b^2, and capable of vertical adjustment (for length).

b^5, a weight adjustable on a screw attached to the lower edge of B, for poising b^3, &c. properly.

b^1, the *moveable shield*, composed of very light sheet-brass, flat, and having its upper edge curved to a radius of 12 inches, and attached to b^3. It has a very narrow slit at the centre of its upper edge.

O is a diaphragm plate, whose aperture is about an inch long (horizontally), and a quarter of an inch wide; it is supported by two angular plates (as o^3) resting upon X, and attached (with means of adjustment) to g^1 by screws passing through slits.

o^1, the fixed shield attached to O by means of a little bolt, washers and nut, o^2. It is capable of adjustments for horizontality, height, &c. At about three-eighths of an inch from its centre is a slit, somewhat larger than the slit in b^1. The lower edge of this shield stands at about a twentieth of an inch lower than the upper edge of b^1, and at about the same quantity from its interior plane.

C is the shutter apparatus.

c^1 is a plate screwed upon A, and having an aperture about equal to and corresponding with an aperture and little plate of glass in A. It is provided with grooved pieces, between which slides freely c^2.

c^2 is a plate having an aperture (c^3) equal to that of c^1 and A, but corresponding with the latter only when it has slid into its lowest position.

c^4 is a small line attached at one end to c^2, passed over a pulley, c^5, under another pulley, c^6, and fixed to a lever, c^7 (fig. 7, Plate I.), within the clock case K, which lever is attached to the apparatus used for stopping and starting the clock (*vide* k^2, Plate II. of the Report of the British Association for 1849).

The object of this arrangement (C, &c.) is to admit light into A at the moment of starting the clock, and to exclude light therefrom at the moment of stopping it.

D (Plate I. fig. 1) is a modification of Count Rumford's polyflame lamp, having three flat wicks and rack-work to raise them.

d^1, its high, squared copper chimney, with a narrow glass plate opposite to the best part of the flame.

E (Plate II. fig. 1) is the mouth-piece, in section, consisting of two angular pieces and of two little plates attached to them, forming the lips and aperture e^1, which aperture can be diminished or increased at pleasure, with great and *requisite* accuracy; for,

e^2 is a plate screwed upon a^1.

e^3 e^3 (fig. 3) are two screws, which, freely sliding through e^2 and screwing into the upper portion of E, are employed to elevate that portion.

e^4 is another screw, screwing through e^2 and pressing occasionally upon the upper portion of E. This is employed to move it downwards (when the mouth is to be more nearly closed e^3 e^3 must, of course, be released before e^4 is screwed downwards, and *vice versâ*).

A narrow vertical slit is cut in the lower lips of E, as shown in fig. 3, and a horizontal aperture of about 3 inches long, and about a quarter of an inch broad, (not shown) is cut through a^1 for the passage of light to e^1.

F is the slider-case for receiving the sliding-frame.

f^2, a perfectly true ruler of brass attached vertically to a^1 by means of three screws passing through it, through three little pillars and through three oblong slits in a^1, &c., which admit of its vertical adjustment.

f^3 is a roller spring attached to a^1, and acting upon H laterally, pressing it gently against f^2.

f^5 is a pair of similar springs acting upon H in front, and pressing a plate belonging to it (to be presently described) against E.

G is the lens tube containing two groups of achromatic lenses (by Ross), and of curvature specially adapted to the purpose. The range of the image of the slit in the moveable shield is four times greater than the range of the slit itself (*vide* fig. 2. Plate I.).

g^1 is apparatus of sliding plates, &c., for support and due centring of G.

g^2 is apparatus of stud, pinion, milled-headed key, &c., for moving the rod g^3 which is attached to the stud at g^4, and serves for adjustment to focus (of G).

H is the sliding-frame suspended in F. h^4 is a door closed by means of three little turn buckles, h^5. Upon its interior side are fixed three springs, h^1, for retaining the Daguerreotype plate y (or a glass plate, if Talbotype paper is used) in its proper place.

h^2 are the three friction rollers.

h^3, a hook with a little peg in it, which attaches it to a clock chain.

h^6 is a brass plate capable of sliding freely in a groove in H.

When both h^6 and H rest on the bottom of E, h^6 covers entirely y (of course not touching it); and the height of h^6 is such that when placed in F properly its upper edge always stands at about one-twentieth of an inch below the opening of the mouth at E, as shown by the dotted line; but when H is drawn upward (carrying V with it and leaving h^6 still resting on the bottom of E), portions of V are successively exposed to the action of light passing from the lamp (or daylight) through the slit in b^1, the lenses in G and the aperture e^1.

At the upper end of h^4 a narrow aperture and a piece of finely ground glass is placed opposite to it and above y, for the purpose of receiving the image (before the clock is started), and the microscope, f^6 (fig. 1. Plate I.), is used in examining the image on the ground glass for focus and *colour*.

I is the pulley on the hour-arbor (or barrel arbor) of the time-piece. Its diameter is somewhat less than 4 inches. It moves H upwards at the rate of an inch per hour: but a pulley of half that diameter may be substituted for it, and the *time-scale* thus diminished to half an inch per hour if required.

i^1 is the clock chain by which H is suspended from I; and

i^5 is a counterpoise to H, &c.

K (fig. 1. Plate I.) is the time-piece.

k^2 (fig. 7.) is the back view of the lever and fork, &c. above mentioned, attached to an arbor passing through the clock plates, and furnished with a milled-headed nut (not shown in front), and by a spring and detent, k, by means of which the fork can be made to stop or to release the pendulum at any given second.

K^1 is the frame supporting K & F (*vide* Plate I. of former Report).

k^3, brass tubular braces.

P^N & P^S (fig. 1. Plate I.), are stone pillars whose common centres are in the mean magnetic meridian (about).

Q Q are two of four brass tubular columns.

q^1 and q^2 are screws and nuts which enter and clamp those four columns to two marble slabs.

R is the lower slab of black marble resting on P^N.

r^2 r^2 are bolts and nuts which firmly secure the magnet support upon R.

S is the support of and apparatus for raising and lowering the magnet of Dr. Lloyd's construction, but without the cross wires, &c.

s^1, the base.

s^2, four leveling screws.

s^5, pieces carrying the agate pallets.

s^6, frame-work moveable by means of a key, &c., for raising the magnet off from its pallets.

T, a squared brass tube passing through V into A.

X is the upper black marble slab carrying A, G, a^1, K^1, &c.*

Some minor improvements have been made in the apparatus used for the preparation, &c. of the Daguerreotype plates, viz. on the polishing board, Plate I. fig. 3; the buffs, fig. 4; the coating boxes, fig. 5; and the burning-off and fixing stand, fig. 6.

The Polishing Board.

A (fig. 3. Plate I.) is the mahogany board.

a^1 a^1 are screws which attached it to a firm table.

B is a piece of mahogany attached to A by means of two screws.

b^1 b^1 are the two screws which pass through it and screw into A.

b^2 b^2 are two pins fixed firmly in B but sliding stiffly in A.

b^3 is a rim (or edging) of thin sheet brass attached to A and projecting upwards a little less than the thickness of a photo-plate.

b^4 is a similar edging of sheet brass attached to B.

The surfaces of b^3 and b^4 are always in exactly the same plane, and the photo-plate may be firmly held between them by using the screws b^1 b^1.

The Buffs.

A (fig. 4.) is a deal board 1 inch thick in the middle and $\frac{3}{4}$ inch at each end. Its lower surface is bellied (in the manner of a large file), and covered first with flannel and then with thick plush cotton velvet. It is rubbed across the plate. Its handle (a^1) is glued and screwed firmly upon it.

The Coating Boxes.

A (fig. 5.) is the deal box.

a^1 a^1 are the usual openings in its sides.

a^2 is the door which carries the usual mirror (on its interior face).

a^3 a^3 are strips of mahogany with screws and washers which fix them upon the edges of A but allow them to be approached towards, or withdrawn from each other a little, in order that any sliding-frame, as H, may fit exactly between them.

a^4 is a little projecting piece to support the glass plate below mentioned.

B is the glass cistern fitted into A, and containing crystals of iodine, distributed on the bottom.

b^1 is the glass plate cover of B resting on its upper edges and projecting beyond A.

H is the sliding-frame containing the photographic plate (or paper) and

* This vertical-force magnetograph was shipped for Toronto on the 23rd of March, and Captain Lefroy, the Director of the Royal Observatory of Toronto, has acknowledged the arrival of it as well as of the horizontal-force magnetograph. I understand that he has mounted and successfully worked this latter instrument.

its sliding plate h^6 (*vide* fig. 1. Plate II.), with a little handle for withdrawing it in order to expose the photo-plate to the action of the iodine, &c.

The Burning-off and Fixing Stand.

A (fig. 6.) is a heavy mahogany board.

a^1, a milled-headed screw passing through A and projecting (about half an inch) below it.

a^2 a^2, two little brass feet projecting (about the same quantity) below.

B is another heavy mahogany board.

b^1, another screw similar to a^1 and pressing on A.

b^2, one of two feet similar to a^2 a^2, also resting on A.

C C, two tubular pillars fixed upon B.

c^1 c^1, two wires attached perpendicularly to caps on C C, which caps can turn on their axes.

V is a photo-plate resting on c^1 c^1.

The axes of a^2 a^2 are in a plane perpendicular to the plane of the axes of b^2 b^2. This stand allows of much more rapid adjustment for horizontality than the usual stand having three adjusting screws.

About the end of the month of February last, I think, Sir John Herschel proposed a very ingenious method of procuring surfaces in relief (as in wood engravings) on gelatine paper, which should exactly coincide with impressions procured on the gelatine by photographic means, in order that they might be employed in printing.

On hearing of this, I suggested to Colonel Sabine the expediency of engraving gelatine paper as if it were actually copper, with the figures of the magnetic and other curves on our Daguerreotype plates, by using the gelatine as tracing-paper commonly is used for the purpose of copying drawings, &c., and also of employing such engraved gelatine as copper plates are employed for printing any required number of copies of such magnetic and other curves.

The experiment succeeded on the first trial.

Specimens are preserved in our Journal of gelatine paper thus engraved, and of declination, horizontal force, and barometric curves as *printed* from the gelatine.

The ordinate board has been slightly modified to render it useful in this process.

The method of Sir John Herschel, however, will certainly be found far preferable to this, when chemical difficulties have been conquered, as I sincerely hope they will be.

In order to correct certain errors of the clock's rate—errors arising from expansion, &c.,—it has been found necessary sometimes to divide the time-scale belonging to the curves produced into equal parts. An instrument, correct in principle at least, and which I hope to render an accurate and generally applicable mathematical instrument, has been experimented upon.

Its principle of action is that of a well-known instrument called the "Lazy-back," and will be instantly understood by reference to Plate III. figs. 2 and 3 (the perpendicular rods are *fixed* to the lower joints, but slide through the upper ones).

It is evident that the points of this instrument cannot be brought very close to each other: if, therefore, minute divisions of a scale are required, the first large division may be subdivided by means of a pair of parallel dividers (figs. 4 and 5), which, it may be readily seen, is an instrument constructed on similar principles to the above, but allowing the points to touch each other. The first large division having been so subdivided, the first instrument (figs. 2 and 3) may be evidently so applied as to divide with accuracy, facility and dispatch, each of the other large divisions into the same subdivisions "without stepping."

In the early part of the year many experiments were made on electrotyped and other kinds of plates. It was found that the former were preferable.

About the end of April Mr. Ross's portion of the horizontal-force magnetograph already alluded to arrived, and claimed our attention and labours. It was placed on the corbels in the Quadrant Room, which had been occupied by its predecessor the vertical-force magnetograph sent to Toronto. No material variation was introduced differing from those already described relative to the vertical-force instrument, excepting such as were required for its special object. It was so arranged, that it might be, with very slight variations, used either for a declination or horizontal-force magnet. The gold-paper covering of the magnet-case is dispensed with, yet this magnet seems to be as quietly disposed as the former horizontal-force instrument. Increased diligence has been used for promoting accuracy, &c.

In concluding this Report, I will only allude slightly to a little correspondence which I have had with gentlemen who seem obligingly disposed to second my views as to the establishment of electrical observatories, both in this country and in distant parts of the globe, and have proposed to them a portable modification of mine at Kew, which would, I believe, be found efficient in promoting a more extensive range of inquiry into the interesting subject of Atmospheric Electricity.

Report on the Investigation of British Marine Zoology by means of the Dredge. Part I. *The Infra-littoral Distribution of Marine Invertebrata on the Southern, Western, and Northern Coasts of Great Britain. By* Edward Forbes, *F.R.S., Professor of Botany in King's College, London, and Palæontologist of the Geological Survey of the United Kingdom.*

At the Meeting of the British Association at Birmingham in 1839, a Committee was appointed for the investigation of the Marine Zoology of the British seas, by means of the dredge; and at the joint recommendation of the Natural History and Geological Sections, a sum of money was granted towards its expenses. Ever since that time the Committee has been annually reappointed, with grants of various amounts placed at its disposal. At each meeting, a provisional report, stating the nature and success of the researches conducted during the interval, has been presented. A considerable mass of valuable materials having been collected, it is now proposed in this Report to present the results in connexion, in such a form as may be useful to science. The extent and value of the data will sufficiently prove the expediency of the researches.

For some years past much attention has been paid to marine zoology by the naturalists of Europe and America. Among the inhabitants of the sea, are many creatures whose organization is as attractive to the physiologist as the singularity of their shapes to the students of external conformation. Many of them were apparent anomalies in their respective classes, and of doubtful position in the animal series. To throw light on the general history of animal tissues, and on the various modifications of vital organs, to fill up gaps in the scale of being as known to zoologists, to ascertain whether in the depths of the ocean there are not still remaining the analogues and homologues of apparently lost species, and the representatives of unknown or conjectural