

# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

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### FLOODS, AND A PLEA FOR FLOOD MARKS.

THE recent floods have not been so great as those of November, 1852, and we are not sure that they have equalled those of 1875, but they have been very extensive ; they have done considerable damage, and have rendered hundreds (probably thousands) of houses very unsuitable for occupation. They have washed autumn-spread manure almost entirely off the fields ; they have, it is true, flushed our sewers ; but, as regards public health, the gain in this direction will be more than balanced by the ill effects of protracted damp.

Our usual monthly table shows that the rainfall of December, 1876, was excessive—in London it was the greatest in any month for at least twenty years, and more than four times the average. The fall in the South-east of England during the first fortnight of January has also been excessive and continuous, as is well shown by the following detailed table.

We have put at head of this article "A Plea for Flood Marks," and we beg of our readers to do all in their power (1) to discover and protect all existing records of the height of bygone floods ; (2) wherever practicable, to have their relation to Ordnance datum accurately determined, and, when that has been done, to send us for publication a note of the results ; (3) to have new marks of the level of the 1877 floods cut wherever practicable, if possible determining their height above Ordnance datum, and reporting the details to us for publication. A mere horizontal line or, better still, a mark like this  $X \overline{1877} X$  is all that is necessary.

It may be thought that in making this suggestion we are passing beyond our own province, into that of Engineers. Limits are always hard to fix, and if there existed any published details of the class we indicate we should not interfere. But although the records of the floods of continental rivers are kept with accuracy and published extensively, we do not know where to obtain similar data for English rivers and floods. We have had to create an organization for the registration of rainfall,—shall we be obliged to supplement it by a Chronicle of Floods ?

# DAILY RAINFALL, JANUARY 1ST TO 14TH, 1877.

Stations.	Observer.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Camden .....	G. J. Symons .....	.18	.31	.45	.02	.12	.31	.49	.60	.02	.57	.07	...	.05	.27	3.46
Selborne .....	T. Bell .....	.28	.88	.43	.14	.53	.79	.64	.71	.03	.37	.08	...	.14	.40	5.42
Hitchen .....	W. Lucas .....	.21	.05	.65	.01	.07	.35	.08	.28	.02	.37	...	...	.02	.25	2.36
Banbury .....	T. Beesley .....	.11	.09	.84	...	.20	.47	.02	.05	.04	.40	...	.02	.02	.30	2.56
Culford .....	P. Grievé .....	.17	.03	.56	...	.05	.12	.19	.35	.09	.32	.02	...	.03	.13	2.06
Sprouton .....	T. Cozens Hardy .....	.10	...	.59	.01	.01	.07	.17	.25	.11	.02	.07	.02	.06	.17	1.65
Bridport .....	G. M. Evans .....	.02	1.22	.31	.15	.24	.61	.24	.40	...	.36	...	.09	.30	.20	4.14
Barnstable .....	W. Knill .....	.08	.60	.10	.16	.35	.40	.03	.05	.02	.29	.13	.05	.16	.31	2.73
Bodmin .....	J. Liddell .....	.26	1.40	.42	.15	.49	.99	.16	.03	.08	.24	.30	.01	.25	.38	5.16
Cirencester .....	J. Bravender .....	.08	.50	.75	...	.18	.38	.03	.09	...	.29	...	...	.07	.30	2.67
Shaftal .....	J. Brooke .....	.08	.06	.92	...	.13	.31	...	...	.11	...	...	.09	.11	.27	2.08
Orleton .....	T. H. Davis .....	.19	.20	.77	.06	.10	.33	.07	.01	.04	.05	...	.02	.07	.40	2.21
Leicester .....	H. Billson .....	.10	...	1.28	.02	.09	.17	...	.13	...	...	...	.01	.04	.26	1.82
Boston .....	W. H. Wheeler .....	.05	...	.90	.07	.05	.11	.05	.01	...	...	.05	...	.05	.16	1.50
Grimsby .....	J. Byron .....	.21	.02	1.51	.03	.08	.30	.07	.01	.01	.01	...	.01	.04	.31	2.60
Mansfield .....	R. Tyrer .....	.27	...	.81	.64	.42	.50	.39	.02	.05	.01	...	.11	.09	.65	3.96
Arncliffe .....	W. Boyd .....	.38	...	.71	.18	.30	.16	...	.01	.06	...	...	...	.02	.09	1.91
North Shields .....	R. Spence .....	.08	.63	.72	.01	.23	.21	.04	.05	.17	.53	...	.05	.25	.19	3.03
Cardiff .....	W. Adams .....	.36	.73	.07	.10	1.31	.40	.10	...	.32	.32	.10	.04	.30	.36	4.96
Haverfordwest .....	E. P. Phillips .....	.22	.09	1.24	.36	.72	.56	.05	...	.04	...	...	.10	.34	.36	4.36
Machynlleth .....	J. Johnstone .....	.06	...	.60	.17	.25	.48	.03	.09	.04	...	...	...	.05	.30	2.07
Llandudno .....	J. Nicol .....	.05	...	.23	.12	.07	.33	.05	...	.03	...	.02	.04	.07	.19	1.20
Aberdeen .....	A. Beverley .....	...	.57	.66	.08	.14	.75	.03	.08	...	...	.28	.06	.43	.07	2.95
Waterford .....	E. Garnett .....	.59	.13	1.40	.02	...	.75	...	.07	...	.02	.03	...	.10	.09	3.13
Monkstown .....	G. Pin .....	.04	.01	.90	.22	...	.35	.32	.07	.10	.04	.23	.04	.24	.17	2.73
Warrington .....	T. Waring .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

## ADDITIONAL STATIONS IN SOUTH-EAST ENGLAND.

Beckenham .....	P. Bicknell .....	.25	.28	.50	...	.08	.47	.31	.62	...	.98	.26	...	.03	.29	4.01
Crowborough Beacon .....	C. L. Prince .....	.77	.74	.61	.24	.27	.57	.35	.95	.03	1.02	.13	...	.26	.50	6.44
Newport, I. of W. ....	E. G. Aldridge .....	.18	1.30	.68	.13	.50	.31	.50	.53	.01	1.57	.02	.30	.01	.17	2.89
Strathfield T. ...	C. H. Griffith .....	..	.39	.40	.05	.12	.52	.19	.43	...	.54	.05	.02	.01	...	...

# SCIENCE AT SOUTH KENSINGTON.

*Concluded from page 159.*

THE temporary or the final closing of the Loan Collection of Scientific Apparatus took place on December 30th, and with the present article we close our series of notices. We, however, think that we ought to state our opinion as to the desirability or otherwise of the permanent maintenance by the State of some analogous exhibition. The past one has been hampered by persistent personal questions, and whether there was foundation for them or not, we think that it was wise to close the exhibition, so that the subject might be considered afresh, and, if possible, independently of personal considerations. If England is to hold her own, it can only be by arousing and developing to the highest degree the faculties of her population. That the *Conservatoire des Arts et Métiers* of Paris tends greatly in that direction no one familiar with that institution can deny. The ordinary educational collections at South Kensington are our nearest approach to a copy of the *Conservatoire*, and it appears to us that the natural growth (and it is a rapid growth) of the Science Department at South Kensington will soon supply all that is really necessary. We do not want *six* opticians to send *six* specimens of *one* instrument, differing only in the pattern of its frame and in the name painted upon it; but every person should be able to see all the ordinary forms of instrument and, at the cost of printing and paper, should be able to learn their mode of construction and use. So much for our views as to the general question; we now resume our list of

## MISSING, MISCELLANEOUS AND SUPPLEMENTARY.

### 2807b. Baroskop.

*G. J. Symons.*

As good an illustration of false nomenclature as can easily be found. This is a very old German camphor-glass (or, as similar ones are often called, storm-glass) of unusual construction in two respects; first in that the glass tube is hermetically sealed, and secondly in that a sort of key to its indications is given by the following wording being painted upon the wood which carries it. We add a rough translation.

BAROSKOP.		BAROSCOPE.	
Helle Flüssigkeit	Schön Wetter	Clear	Fine
Trübe Flüssigkeit	Veränderlich	Thick	Changeable
Kleine Schnee flocken	Regen	Little snow flakes	Rain
Trübe Flüssigkeit und Sternchen	Gewitter	Thick, & little stars	Thunderstorm
Kristallisation	Feuchtigkeit Nebel	Crystallizing	Damp, Fog
Aussteigende Federn	Wind	Feathery	Wind
Starke Wolken	Stürmisch	Thick clouds	Stormy
Sternchen und rarte Kristalle	Schnee	Little stars and a few crystals	Snow
Oben eine Eisdecke	Starker Frost	Ice-like surface	Hard frost
Der Bodensatz oben, u. unten hell	Erdbeben	The sediment all at the top	Earthquake

We should add that the left hand words refer to the condition of the liquid, and the right hand ones to the state of the weather. We may perhaps as well state also that the researches of Tomlinson appear to have demonstrated that the changes which the camphor in these glasses exhibits are solely due to variations of light and heat, and that generally they are regarded as quite useless. Even if they were not, we do not know of anything more ridiculous than to call an hermetically sealed glass tube containing camphor and spirits-of-wine a "weight-looker," or even "weight indicator."

**2826a. Six's Self-Registering Thermometer**, for registering the degree of heat and cold.

*Francis Pastorelli.*

Very good specimens of this instrument, and well adapted for placing outside of windows. In fact, in spite of the liability of instruments of this pattern to be deranged during transmission, they will long remain the favorite form for ordinary purposes.

**2826m. Continuous Self-Registering Thermometer.**

*W. Harrison Cripps, F.R.C.S.*

The object of the instrument is to obtain a continuous registration of heat. The instrument is in two portions: 1st, the thermometer for indicating the temperature; 2ndly, the clock-work for registering the hours and minutes. The thermometer consists of six coils of glass tubing wound concentrically round an axis in such a manner as to form a spiral glass wheel 4 inches in diameter. The last coil is moved slightly away from the others, so that it shall form the circumference of a circle 5 inches in diameter. To each end of the axis a fine needle-pointed pivot is attached. These pivots rest on minute depressions between two parallel metal uprights. By this arrangement the glass wheel can rotate freely between the uprights. The spirit in the thermometer fills the spiral portions of the tube and also 3 or 4 inches of the last coil (the one forming the circle). The spirit then comes into contact with a column of mercury 4 inches in length. Beyond the mercury are a few drops of spirit to moisten the glass. The remaining portion of the tube is hermetically sealed, enclosing a small quantity of air. On the spirit expanding with heat, the column of mercury is driven forwards. This immediately alters the centre of gravity, and the wheel revolves in a direction contrary to that of the moving mercury. When the spirit contracts on cooling, the enclosed air, acting as an elastic spring, keeps the mercury in contact with it, and the wheel regains its original position. By this arrangement the two forces, heat and gravity, acting in contrary directions, generate a steady rotary motion.

The method by which this movement is made serviceable, is by a grooved wheel 2 inches in diameter, fixed to one of the pivots, and therefore revolving with the thermometer. Fixed to and passing over this wheel is a fine thread, from which is suspended a pencil holder, moving up and down on a vertical slide. The pencil will be raised or lowered according to the direction in which the wheel is moving. The other portions of the clock-work are arranged in a manner similar to that employed in the barograph.

In the present instrument a cylinder  $4\frac{1}{2}$  inches, both in width and diameter, is made to revolve once in seven days. Around this cylinder is placed a paper, on which the days and hours are indicated by vertical lines. The cylinder is so placed that the surface of the paper is one-tenth of an inch away from the pencil point, moving at right angles to its surface. A small striker is connected with the clock work in such a manner that at every quarter of an hour it gives the pencil a tap, striking its point against the paper.

The extreme delicacy of this instrument would render it difficult of transport, and it is perhaps liable to derangement if exposed for out-

of-door purposes, but in the Exhibition galleries it has worked very well.

**2824. Thermometer of Translation** or Integrator of variations of temperature.

*Scottish Meteorological Society.*

The bar of zinc is fixed at its lower end during expansion by the needle points catching in the teeth of the rack below, so as to produce lengthening upwards, while during contraction the bar is held by the needle at the top, so that the shrinking is upwards. In this way the centre of gravity is moved upwards. The total annual march or creep of the bar will measure the total amount of fluctuation of temperature. Designed by Thomas Stevenson, C.E., Honorary Secretary.

The following three instruments must be regarded, we believe, rather as models than as constructed for actual use, but we are not sure. They do not look as if intended for durable hard work.

**2831. Anemometer**, for ascertaining pressure of wind.

*Scottish Meteorological Society.*

This anemometer acts by lengthening (not compressing). The maximum result is recorded by the thread, which is fixed to the rod and pulled through a hole in the brass plate fixed to the side of the box. To ascertain the maximum elongation which takes place, press the thread against the plate, then push in the disc until the part of the thread which has been drawn through the hole is again tightened, and read off the result from the graduated tube. The small disc is for high winds, the large for light. Designed by Thomas Stevenson, C.E., F.R.S.E., Honorary Secretary, and described in the Society's Journal, vol. iv., p. 266.

**2832. R. Ballingall's Anemometer**, for continually registering the pressure of the wind.

*Scottish Meteorological Society.*

This anemometer consists chiefly of a cistern of mercury in the left-hand chamber, with a wooden plunger which acts in connexion with the pressure plate. There is an arrangement by which the accuracy may be tested at any time. Designed by the late R. Ballingall, and described at the general meeting of the Society, 2nd July, 1874.

**2839. Balance Anemometer**, constructed by Mr. Francis Ronalds, at the Kew Observatory, in 1843, for the purpose of measuring the force of the wind.

*Kew Committee of the Royal Society.*

It consists of a light board, 1 foot square, fixed transversely to a cross of wood, suspended by a brass axis passing through its centre, and turning in glass tubes in such a way that the cross can partially rotate in a vertical plane. The lower end of the bar carrying the board is counterpoised so as to keep the surface of the board vertical, and a scale pan, hung to one end of the horizontal bar of the cross, serves to receive the weights which are necessary to counterbalance the force of the wind, pressing on the board opposed to it, at any time. A small box, covering the scale pan, serves to shield it from the action of the wind. The instrument was, at the time of observation, placed so that the surface of the pressure plate should stand at right angles with the direction of the wind, as indicated by a vane.

**2938. Mohn's Thermometer Screen** for meteorological stations of the 2nd order. In use at the stations of the Norway Meteorological Institute.

*Professor H. Mohn.*

Made of plate iron. To be mounted outside a window and kept in shade. The screen contains one psychrometer (dry and wet bulb), one minimum thermometer, and one hair-hygrometer.

A thin painted iron screen, somewhat the shape and pattern of those

supplied by Admiral FitzRoy (in wood) to carry thermometers on board ship.

**2939. Mohn's Thermometer Screen** for one single thermometer for obtaining the temperature of the air. In use at stations belonging to the Norway Meteorological Institute. *Professor H. Mohn.*

Made of plate iron. To be mounted outside a window or on a wall, and kept in shade.

A tin cylinder about a foot high and three inches diameter.

**2940. Mohn's Thermometer Screen** for one minimum thermometer. In use at stations belonging to the Norway Meteorological Institute. *Professor H. Mohn.*

Made of plate iron, with double walls. Suspended by a cylindrical rod intended to pass through the window-frame. The rod has a handle inside, so that the screen with the thermometer can be turned for "setting." The double walls prevent the rising of the thermometer, even in direct sunshine, to more than a few degrees above the temperature of the air.

An oblong box open at one side, so that the thermometer can be seen; the box is horizontal, except when the index is being set.

**2929. Meteorological Stand, with Psychrometer case**, as used in the Imperial Navy. *C. Bamberg, Berlin.*

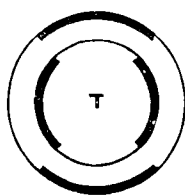
A rather neat tripod stand with the thermometer case swinging pendulum-like from the centre. Excessive motion is counteracted by a heavy weight being attached to the bottom.

**2931. Reinert's Meteorological Window Stand**, used at the stations of the German Nautical Observatory.

*Deutsche Seewarte Hamburg.*

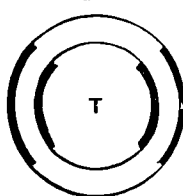
This seems to be the best of the window screens. It consists of four concentric iron rings, one pair about 2 feet above the other. The larger rings are about 2 feet in diameter, the smaller about 18 inches; two opposite quadrants of each pair of rings are joined by sheet zinc—but we can make this clear only by asking our readers to imagine that figs. 1 and 2 represent horizontal sections of two zinc cylinders, each only half filled, *i.e.*, consisting of two quadrants. In fig. 1 the open quadrants of the inner circle are covered by the closed quadrants of the outer, and this is the normal position of the apparatus. At the time of reading, by means of an extremely ingenious arrangement of levers, the frame is drawn towards the window and the closed quadrants automatically placed opposite the one to the other, and thus the instruments at T are readily seen.

Closed.



*Fig. 1.*

Open.



*Fig. 2.*

Several specimens of **Stevenson's Thermometer Stand** were exhibited, but it has been so often described in these pages that we need only mention it as being in the collection.

**2876. Electrical Self-recording Anemometer and Printing Apparatus**, invented by the Contributor. *J. E. H. Gordon, B.A.*

The description of this instrument has, by some queer dispensation of fate, been divided into three parts, two other portions being numbered respectively 2833 and 2834. The instrument will be best understood by those acquainted with the patterns of anemometer employed in this country if we say that it is a Beckley anemometer recording by electricity. We leave the inventor to say the rest, correcting, however, a few obvious misprints, one of which is very amusing.

The Beckley Fan Apparatus for Direction moves two contact breakers, one when the wind shifts in the direction N.E.S., the other when it shifts in the direction N.W.S. On turning the fans so as to move the pointer, two points or one-sixteenth of a revolution in either direction, the hand of the pointer will be seen to follow it. There is a falling weight to avoid continuous contact.

At the end of each mile of wind which passes over the apparatus an electrical contact is made, which depresses the armature of a little magnet behind the clock face in the printing instrument, and makes a dot on the paper, as may be seen by turning the cups in the direction marked by the arrow until the weight falls.

The figures on the left hand side of the paper give the hours, those on the right the direction of the wind at each quarter of an hour, while for every mile of wind that passes over the cups a dot is made in the centre of the paper. The number of dots between any two consecutive figures is the velocity in miles for that hour. The communication with the roof being made by electricity, no shaft is required.

**2850. Ship Rain Gauge.** *Scottish Meteorological Society.*

This is one of Surgeon-Major Black's gymbal-swung gauges, of the class referred to on p. 34 of our present volume.

**2911a. Goddard's Cloud Mirror.** *G. J. Symons.*

This is the identical instrument shown (by Mr. Goddard, the inventor) in the 1851 Exhibition. It is larger than, but very similar to, the following.

**2926. Cloud Reflecting Compass.** For ascertaining direction of higher currents of air. *Scottish Meteorological Society.*

When a cloud is to be observed the compass should be turned round till one of the lines on the mirror coincides with a well defined edge of the cloud, and the compass is then made to revolve gradually, keeping the line constantly on the edge of the cloud. The angle indicated by the magnetic needle being afterwards read off, the direction of the cloud's motion in azimuth is at once ascertained. Designed by Thomas Stevenson, C.E., F.R.S.E., Honorary Secretary, and described in the Edinburgh Philosophical Journal, 1855.

**2913b. Dietherscope.** *Professor Luvini.*

An optical instrument designed principally for observations upon atmospheric refraction.

**2905. Ozonometer**, for the determination of the amount of ozone in a measured volume of air, by means of an aspirator; invented by the exhibitor, and described by him before the British Association at Birmingham, in 1865. *John Smyth, junr.*

2905a. **Schonbein's Ozonometer**, rendered self-recording. An instrument for exposing for each hour a fresh piece of Schönbein's ozone test-paper to the influence of the atmosphere.

*R. C. Cann Lippincott*

Finally, though we cannot find it entered in the catalogue, we desire to record the thanks of all who value "true time" to Messrs. E. Dent for the splendid time-keeping of their barometrically compensated clock. Although we do not agree with a learned friend who declared it was "never the ten thousandth of a second wrong," it certainly went marvellously well, fully sustained the opinion we expressed\* when the arrangement was first devised for the Royal Observatory, and was a boon to every one who knew in which clock to trust.

### REVIEWS.

[It is surely a healthy sign when the literature upon any branch of science is so great as to render it impracticable for journals devoted to that subject to keep their reviews abreast of the publications. Our excellent contemporary the *Zeitschrift* does not notice a tithe of the meteorological literature of the day, and we also are sadly in arrear. A hundred pages of this magazine would be worthily devoted to the criticism of the pile of books, papers and pamphlets still waiting for notice. There is but one remedy available, viz., to practice even greater terseness than usual. But that is not easy, for it has ever been our aim to act up to the final words of the address in the first number of this magazine, written in February, 1866,

"Our maxim always is, say everything in as few words as possible," and we doubt if the principle could be carried much further than we have done. However, we must try, and if some of the reviews are more terse than elegant, our readers will know that it solely arises from our desire to keep them acquainted with the current literature of the meteorological world.]

*Histoire du Thermomètre*, Par M. E. RENOU, Excerpt from the *Annuaire de la Société Météorologique de France*, 1876.

M. Renou possesses the somewhat rare qualities of a systematic meteorological observer, and of a meteorological bibliographer. The latter qualification is, we regret to say, extremely rare, and consequently there exists the prevalent fallacy that all that is contained in modern meteorological books is new, and that the old ones contain little that is true. This, however, is a digression, and digressions are not consistent with the notice at the head of this review.

The present paper occupies 56 large pages, closely printed, with very few lines which do not call for notice or comment, and the whole paper is as terse as the Editor of this magazine could wish. Here, for instance, is the introduction:—

"The history of the thermometer has been written many times, but always either so incompletely or so inexactly that one may say its history has still to be

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written. This it is which has induced me to publish the results of my long researches."

M. Renou states his reasons for believing that neither Cornelius Drebbel nor Santorio (often wrongly called Sanctorius) used thermometers, but merely open-ended thermoscopes, and that Galileo appears to have been among the earliest (about 1613) to apply any scale to the thermometric tube. After paying a high tribute to the skill of the Cimento Academicians, and mentioning La Hire's journey to Florence and the subsequent construction of a thermometer in Paris by Hubin, he states that Robert Hooke, in his *Micrographia*, published in 1667, was the first to describe a thermometer with one point of its scale (the freezing point of water) properly fixed. All these thermometers were filled with alcohol. Priority as to the idea of employing mercury is assigned to Halley, in consequence of his paper in the *Philosophical Trans.*, 1693, and he is also credited with regarding the temperature of boiling water as fixed. (Approximately of course, we now know that it varies with the barometric pressure). Almost simultaneously, Renaldini, a professor at Padua, thought of using this boiling-point temperature as the means of fixing the upper point of the thermometric scale, just as the melting of ice had been for the lower. Subject to refinements, these are the points still used. A few paragraphs are devoted to the efforts of La Hire, and his experiments upon the temperature of the caves of the Paris Observatory, and then reference is made to Sir I. Newton's paper in the *Phil. Trans.* 1701, wherein M. Renou states that he finds the earliest indication of the temperature of the human blood, although usually it has been attributed to Boerhaave; and in the same page he demolishes the pretended discoveries of Amontons, and shows that they had all been previously made by Halley, Renaldini and Newton. After a carefully written notice of the life and labours of Fahrenheit, and also of De Luc, M. Renou winds up the first part of his paper with three paragraphs, which show clearly the error of regarding Celsius' thermometer and the centigrade thermometer as identical. We translate the leading facts.

"In 1742, Celsius, a learned Swede, designed a mercurial thermometer of which 0° was at boiling point and 100° at freezing point. This was not the true centigrade thermometer, and they are wrong in Germany in calling the centigrade thermometer the thermometer of Celsius."

"It is indisputable that the centigrade thermometer is due to Linné; the fact is shown by a letter from this illustrious man, quoted by Arago, T. V. p. 608, and M. Hildebrandsson, of Upsala, assures me that Linné's title to the invention is indisputable."

The third section of the work is principally devoted to a history of the various modes adopted for determining the boiling point, and it is shown that Cavendish, in 1777, was the first to indicate the proper method.

The fourth section deals with the shifting of the zero point, and, by a series of quotations, shows (1) that Flaugergues, of Viviers, was the first to observe the fact; (2) that Bellani was the first to announce it as a necessary result of the contraction of the glass; and (3) that the

general publication of the fact is due to Pictet, of Geneva. M. Renou rather neatly demolishes the suggested claim of Arago to the discovery, by putting in juxtaposition two statements by Arago on the subject.

In section five M. Renou discusses the precise conditions under which the boiling point should be fixed ; he approves generally of those adopted by the English Royal Commission, but suggests a slight modification in the third term of the formula.

Section the sixth is devoted to special forms of thermometer, and section the seventh principally to thermometers employed for hypsometric purposes and as measures of solar radiation. M. Renou would have found, in the late Mr. Nunes, a violent opponent of the last paragraph of this chapter, which is to the following effect :—

“Hence it results that we may substitute for the sun thermometer, a spherical blackened bulb thermometer, placed in a clear glass jacket filled with nearly dry air, which can easily be effected by means of chloride of calcium.”

We do not claim to speak with authority on this point, but it is diametrically opposed to the results at which Nunes arrived, and if accepted at once disposes of the necessity for Negretti's patent test gauge solar radiation thermometer, and for Hicks' vacuum test. Surely some one will have something to say upon this point?

Section eight treats of registering thermometers ; the rather impractical ones proposed by Bernouilli in 1693 are mentioned first, then those of Cavendish, Six and Rutherford. With reference to the maximum of the last inventor, M. Renou states that he has found that a cleanly cut section of hemp makes a better index than the usual steel needle, but nothing will induce us to regard it as equal to Negretti's or Phillips's maximum.

It is with reference to this last thermometer—Phillips' Maximum—that M. Renou has made almost the only mistake in his excellent and singularly impartial paper. M. Renou writes :—

“Dans la séance, de l'Académie des Sciences du 24 Avril 1854, M. Walferdin a fait connaître une manière très-simple de faire un thermomètre à maximum de tout thermomètre à mercure, pourvu qu'il y reste une très-petite quantité d'air.”

M. Renou then describes the construction and various uses of what Englishmen know as Phillips' Maximum, but he concludes with the following paragraph :—

“Depuis quelques années les Anglais ont adopté ce thermomètre qu'ils appellent thermomètre maximum de Phillips, mais à tort, l'invention appartient bien positivement à M. Walferdin.”

Frenchmen have been so long accustomed to call this pattern of thermometer by M. Walferdin's name, that we do not ask them to abandon it, and we do not for a moment assert that M. Walferdin knew that he was re-inventing an old instrument. It is one of the advantages of the improved intercourse of recent years, that the mental waste of duplicate invention is rarer than it was ; but there is still a frightful waste of mental power, through men not knowing what others have done before them. That, however, is a digression. A single reference to a work which is probably in M. Renou's library, certainly

in that of the Institute, will settle the point, viz., *Second Report of the British Association*, 1832, p. 574\*, where will be found "Description of a new Self-registering Maximum Thermometer, by John Phillips, F.G.S."

Phillips invented and made many of these instruments in 1832, but being a geologist, and not a tradesman, they remained for some years little known. We believe there was one in the 1851 Exhibition, but it passed unnoticed, and they would perhaps have remained so, had not the construction and sale been taken up by Casella, from which time they have been very largely used.

We might refer also to the *British Association Report*, 1856, part II. page 41, where it states, "These were first exhibited at the Oxford meeting of the British Association in 1832;" also, "Mr. Phillips constructed many twenty-five years since," i.e., in 1831—nearly a quarter of a century before M. Walferdin read his paper.

Chapter IX. give a short but very accurate history of metallic thermometers, from their invention by Musschenbroek to the present time. Johnson's pattern appears to be unknown to M. Renou.

Self-recording thermometers are discussed in Chapter X., but much more briefly than other forms; Van Rysselbergh's apparatus is warmly commended.

The eleventh and last chapter is introduced by the following words: "Arrived at the end of our task, we may ask ourselves, what is the present state of thermometry, what are the developments which still await it, and what is its future?"—In reply, M. Renou points out the necessity of determining the co-efficient of the cubical expansion of the glass used for thermometer tubes, and the desirability of comparing alcohol and air thermometers at very low temperatures. And he concludes with a strong plea, in which we join, for the general use of the *thermomètre fronde*.

We also have "arrived at the end of our task," and, looking back upon the whole of M. Renou's paper we unhesitatingly pronounce it to be the most useful memoir upon the subject which has ever been written, a credit to the author, and a credit to the Society by whom it has been published.

### EXTRAORDINARY DRYNESS.

*To the Editor of the Meteorological Magazine.*

SIR,—I really am not joking. Yesterday, at the top of my parish, 10 ft. above ground and 2,312 ft. above sea level, I observed the dry bulb to be 24°·5, and the wet 18°·9. I sat on the top of the cairn a quarter of an hour, during which time the reading varied from 24°·0 dry, and 18°·5 wet to the above. The sky was cloudless, except in S; air clearer than I ever before observed. Scawfell Pikes, in Westmoreland, appearing quite within a walk, although 50 miles off at least. The time was 3.30 to 3.45 p.m. At Hestholm the air was not particularly dry that morning—dry 25°, wet 24°. F. W. STOW.

*Hestholm, Wensleydale, Yorks, Jan. 3rd, 1877.*

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\* In another edition, p. 580.

## THE COWES STORM.

WE learn with much pleasure that the request implied in our article upon this subject, in October last, is likely to be more than complied with. We have received from Mr. F. N. Broderick, of Ryde, eight photographs, which are both meteorologically and photographically of very great merit. They are beautiful pictures, and, at the same time, striking evidence of the excessive force of the wind. We may especially mention "Mr. Redfern's Cottage," "On the Parade, Cowes," and "Heart Broken." Mr. Broderick, being a professional photographer, has registered the copyright of all the photographs, and, we believe, prepared copies for sale.

We understand that by repeated visits to the scene of the disaster, and by the diligent collection of the testimony of eye-witnesses, Mr. Broderick has collected much information respecting the storm, and contemplates publishing it at an early date. We have forwarded to him what few notes we have received respecting the storm; we trust that observers generally will follow our example, and thereby enable Mr. Broderick to make his record worthy of the storm, and of all parties concerned.

## SUPPLEMENTARY TABLE OF RAINFALL IN DEC., 1876.

[For the Counties, Divisions, Latitudes, and Longitudes of these Stations, see Met. Mag., Vol. XI., p. 28.]

Station.	Total Rain.	Station.	Total Rain.
	in.		in.
Acol .....	5·33	Llanfrechfa .....	11·64
Hailsham .....	8·12	Castle Malgwyn .....	9·44
Andover.....	6·85	Heyope .....	...
Strathfield Turgiss .....	5·17	Rhug, Corwen .....	6·11
Addington Manor.....	5·02	Port Madoc .....	...
Oxford .....	4·87	Melrose .....	8·83
Cambridge.....	3·89	Cessnock, Glasgow .....	7·04
Sheering .....	5·35	Gruinart .....	7·48
Ipswich .....	3·87	Keith .....	6·03
Diss .....	3·29	Strathconan .....	...
Swaffham .....	3·46	Springfield, Tain .....	4·29
Compton Bassett .....	6·65	Skibbereen .....	...
Dartmoor .....	21·91	Glenville, Fermoy .....	9·31
Teignmouth .....	9·89	Tralee.....	8·05
Torrington (Langtree) ..	8·43	Newcastle W., Limerick ..	4·52
Trevarrick, St. Austell..	12·33	Kilrush .....	...
Taunton.....	8·63	Kilkenny .....	8·05
Bristol .....	7·07	Kilsallaghan .....	7·32
Sansaw .....	4·08	Twyford, Athlone .....	7·19
Cheadle .....	6·37	Ballinasloe.....	5·35
Ashby-de-la-Zouch .....	...	Kylemore .....	14·06
Coston, Melton Mowbray ..	5·57	Bangor .....	...
Bucknall .....	4·80	Carrick on Shannon.....	5·76
Walton, Liverpool .....	4·77	Rockcorry .....	7·31
Broughton-in-Furness ..	14·12	Warrenpoint .....	12·99
Stanley, Wakefield .....	5·79	Bushmills .....	6·06
Gainford .....	6·94	Buncrana .....	7·08
Shap .....	10·55		

DECEMBER, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.				Deg.	Date.	Deg.	Date.	In shade
		inches.	inches.	in.				Deg.	Date.	Deg.	Date.		
I.	Camden Town .....	6.25	+ 4.75	1.61	23	23	56.6	3	28.9	23	3	7	
II.	Maidstone (Linton Park).....	5.16	+ 3.33	.80	24	28	54.0	1†	27.0	23	5	...	
"	Selborne (The Wakes).....	9.77	+ 7.02	1.03	3	24	55.0	2, 4	27.0	23	4	8	
III.	Hitchen .....	5.57	+ 4.26	1.05	23	26	52.0	28	25.0	22	8	...	
"	Banbury .....	5.75	+ 4.08	.67	2	27	55.0	28	25.5	23	9	...	
IV.	Bury St. Edmunds (Culford).....	3.97	+ 2.48	.37	24	23	57.0	28	24.0	22	7	11	
V.	Norwich (Sprowston).....	3.26	...	.45	24	21	...	...	...	...	...	...	
"	Bridport .....	9.52	+ 6.15	.84	26	24	57.0	2, 3	25.0	24	9	...	
"	Barnstaple.....	6.91	+ 3.79	.94	16	25	59.0	3	32.0	25§	...	...	
"	Bodmin .....	12.69	+ 7.45	1.92	26	28	57.0	2	29.0	24	2	4	
VI.	Cirencester .....	7.54	+ 5.25	.61	8	24	...	...	...	...	...	...	
"	Shifnal (Houghton Hall) .....	4.75	+ 3.07	.62	2	20	54.0	28	23.0	23	8	13	
"	Tenbury (Orleton) .....	6.85	+ 4.39	.69	2, 26	22	58.0	10	24.2	24	7	11	
VII.	Leicester (Belmont Villas) ...	4.88	...	.67	23	25	57.0	29	26.5	26	4	...	
"	Boston .....	4.26	+ 2.77	.46	26	22	56.0	28	28.0	27	4	...	
"	Grimsby (Killingholme) .....	5.73	...	1.09	5	24	55.0	28	29.0	23	3	...	
"	Mansfield .....	7.47	...	.85	19	26	55.0	28	21.0	26	7	8	
VIII.	Manchester .....	4.44	+ 2.11	.74	5	23	54.0	23†	26.0	27	6	14	
IX.	York .....	...	...	...	...	...	...	...	...	...	...	...	
"	Skipton (Arncliffe) .....	10.53	+ 5.98	1.60	30	28	50.0	3	23.0	23	8	...	
X.	North Shields .....	6.14	+ 3.94	.82	2	28	50.6	28	29.0	1	5	8	
"	Borrowdale (Seathwaite).....	18.31	+ 1.36	3.27	3	23	...	...	...	...	...	...	
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	
"	Haverfordwest .....	8.16	+ 3.33	2.20	26	21	55.0	2	25.0	22	7	14	
"	Machynlleth .....	7.71	...	1.33	26	23	57.0	27	28.0	22	5	...	
"	Llandudno .....	4.17	+ 1.97	.67	20	18	54.5	30	30.0	26	2	...	
XII.	Dumfries (Crichton Asylum).....	8.68	+ 4.66	1.80	27	22	52.0	5	27.0	24**	10	13	
"	Hawick (Silverbut Hall).....	6.70	...	1.42	21	22	...	...	...	...	...	...	
XIV.	Kilmarnock (Annanhill).....	6.14	...	1.20	26	21	52.0	4	28.0	25	6	9	
XV.	Castle Toward .....	...	...	...	...	...	...	...	...	...	...	...	
XVI.	Mull (Quinish) .....	3.33	...	.52	25	14	...	...	...	...	...	...	
"	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...	
"	Grandtully .....	7.70	...	.80	16	22	...	...	...	...	...	...	
XVII.	Braemar .....	8.70	+ 4.93	1.53	3	26	46.2	11	23.3	8	17	22	
"	Aberdeen .....	8.87	...	1.08	23	27	49.2	4	31.3	13	4	16	
XVIII.	Loch Broom .....	5.07	...	.66	20	25	...	...	...	...	...	...	
"	Portree .....	5.31	- 10.34	.89	30	24	...	...	...	...	...	...	
"	Inverness (Culloden) .....	1.92	- .01	...	...	17	49.1	11	28.6	1	8	21	
XIX.	Helmsdale .....	5.56	...	.75	31	27	...	...	...	...	...	...	
"	Sandwick .....	5.95	+ 1.98	.77	30	27	48.8	9	27.6	21	4	13	
XX.	Caherciveen Darrynane Abbey ..	8.90	...	1.60	17	30	...	...	...	...	...	...	
"	Cork .....	8.15	...	1.76	26	20	...	...	...	...	...	...	
"	Waterford .....	...	...	...	...	...	...	...	...	...	...	...	
"	Killaloe .....	5.24	+ 1.75	.54	24*	21	56.0	1	22.0	23	8	...	
XXI.	Portarlington .....	6.00	+ 2.81	.87	3	29	54.0	27	30.0	22	5	...	
"	Monkstown, Dublin .....	8.50	+ 5.88	1.65	2	21	58.0	4	25.0	15	6	...	
XXII.	Galway .....	5.85	...	.75	27	27	56.0	10	29.0	22 †	6	...	
"	Ballyshannon .....	5.21	...	.75	2	23	...	...	...	...	...	...	
XXIII.	Waringstown .....	7.03	...	1.12	2	25	52.0	3	26.0	7, 23	8	20	
"	Edenfel (Omagh) .....	7.67	...	1.37	2	29	50.0	3	25.0	7	12	...	

\* And 29. † 4, 28, 31. ‡ 28 || 24 § 26 \*\*27 †† 23  
 † Shows that the fall was above the average; — that it was below it.

## METEOROLOGICAL NOTES ON DECEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND.

LINTON.—A very mild but wet month, R falling on every day but the 10th, 14th and 17th. Bar. generally low, but especially so on 4th, lower than I have any record of for upwards of 20 years, and lower than the character of the weather in this neighbourhood would seem to justify. Very little frost, but frequent high winds, and almost incessant R, creating floods in the low lands.

SELBORNE.—Month unprecedented for the amount of R, high min., temp., and low bar. On the 4th it was lower than I had ever recorded it (28·40 in.) Wind occasionally very violent through the month, principally from S. and W.

HITCHIN.—1·05 in. on 23rd, the max. fall of the month was melted S, the largest product of S I ever obtained here, there having been no drifting.

BANBURY.—Bar. below 29 in. on 12 days, and below 28 in. on the 4th.

CULFORD.—This has been a month of exceedingly wet but mild weather, the mean temp. being equal to that of the preceding month, November, viz., 42·3; vegetation is consequently in an abnormally forward condition, and trees may be seen almost in leaf, while the bloom buds of the apricot are ready to expand. S fell slightly on the 4th, and also on the 26th, but this soon changed to R, and had nearly disappeared by the following morning. The rainfall of the month (3·97) is considerably more than double the average, and floods are prevalent in this neighbourhood.

SPROWSTON.—Lunar halo at 6.15 p.m. on 3rd, R in evening; low bar. and high wind on 4th and 5th. A mild, damp month; no S, and very little frost; bar. lower than I ever remember to have seen it.

BODMIN.—Mean bar. 29·42 in.; at 5.20 a.m. on 4th the bar. fell to 28·11 in., the lowest ever registered here, except on 20th January, 1872, when it fell to 28·06 in. Mean temp. 46·6; rainfall in excess of that of any month recorded here, by 3½ inches.

SHIFNAL.—The R which fell so copiously in November, continued, with little intermission, through this month, accompanied by much fog or mist, preventing evaporation. On the 4th the bar. fell lower than I ever recorded here (355 ft. above sea level) in 30 years, viz., 28·5 in. at 11 a.m.; beyond a high wind that evening no proportionate result followed. The only days at all fine were 10th to 14th, when R again set in, falling, with five exceptions (16th 22nd, 23rd, 24th and 28th) to the close; the frosty nights (with the exception of 23rd on 23rd-24th) were by no means severe, with only a slight sprinkling of S on 25th. Great floods on the Severn; wind varying from all points; bar. most unsettled, and unusually low throughout the month. [*Erratum*.—Total rain in November should have been 3·99 in. on 17 days.]

ORLETON.—R fell daily the first 7 days, with a remarkable depression of the bar. on the 4th, which at 8.30 a.m. fell to 28·21 in. (uncorrected); from 7th to 15th the weather was less cloudy, with a moderate fall of R. During the remainder of the month the temp. was very variable, with great falls of R, and on the 26th a great fall of S, covering the ground to a depth of 4½ inches, this was quickly followed by fine R, and a rapid rise in temp. Frequent floods in the river have occurred. The total fall (6·85 in.) is the largest that I have registered in the same month for 46 years, the nearest approach being 6·65 in. in 1868, and 5·58 in. in 1860. Mean temp. nearly 3·5 above the average. The force of the wind was frequently great, but of short duration, and the bar. was generally very low; on the 20th it stood at 28·46 in. Distant L seen frequently on night of 20th.

LEICESTER.—The most rainy month in the year next to September; very mild, but little frost; S fell heavily on the night of the 23rd, followed by three cold days, and then a remarkable rise in temp. on 27th. Much land under water at the end of the month.

BOSTON.—Temp. of the month nearly 4° above the average, the two extremes occurred on 27th and 28th, the temp. rose in about 12 hours from 28° to 56°, a range of 28°; this sudden change was accompanied by a great amount of

humidity, which was rapidly condensed on every cold surface, making the interior of the houses excessively damp, on painted walls the moisture ran off on to the floors in a manner never before experienced. The very serious gales experienced on the N.E. coast have not reached here, although we have had some very heavy gales; the rainfall (4·26 in.) is very much above the average, and the river is very full, the banks in some places having broken, the lands are flooded.

GRIMSBY.—27th, at 7 p.m., temp. in house 47°, outside 51°. The month very cloudy and wet; the ground thoroughly saturated. Bar. extremely unsettled, and often very low, but we escaped the heavy gales that were felt both N. and S. of us, and that were so destructive on the E. coast of Scotland, and N.E. coast of England.

MANSFIELD.—This month, on the whole, has been one of gloom, and the rainfall has been excessive, though, thanks to our elevation and the sandy nature of our soil, no harm has been done here.

ARNcliffe.—An unusually wet and dark month, with very little frost.

NORTH SHIELDS.—Fog on 2nd, and weather stormy, two ships lost at the mouth of the harbour; 21st, stormy, seven ships lost at the harbour mouth; 22nd, S, screw steamer wrecked, and on following day a sailing vessel wrecked, both at the mouth of the harbour.

SEATHWAITE.—Ten days on which 1 in. or more R fell.

#### WALES.

HAVERFORDWEST.—A month to be remembered long for its mildness, exceedingly stormy character, remarkable barometric depression, and very heavy rainfall; from 20th to 25th very winterly, the roads one sheet of ice, R freezing as it fell; the Precelly hills covered with S.

MACHYNLLETH.—A very mild, warm month; temp. above 50° on 23 days; the lowest at night was from 18th to 23rd; both the beginning and end of the month warm. S commenced about 1 p.m. on 26th, and fell heavily until the evening, when R began, and the S all gone in the morning; with the ther. at 49° the air felt quite hot.

LLANDUDNO.—10th, a sprig of hawthorn in full leaf and flower, brought in from the hedge; another similar sprig brought in on 17th.

#### SCOTLAND.

DUMFRIES.—Depth of R (8·68 in.) greater than in any previous month of the year; generally wet, with high winds. Heavy fall of S on 26th. Mean temp. during the month 40·4, or 1·61 higher than corresponding month of last year.

HAWICK.—Severe storms of S, R and wind on 21st, 22nd, 26th and 27th. A gloomy month, the summits of the hills were rarely visible; frosty weather would be more acceptable to gardeners and farmers, to enable them to get their manure wheeled and carted out.

ANNANHILL.—Rainfall heavy (6·14 in.) on 21 days; 1·20 in. on 26th, with easterly wind; prevailing winds E. and S.E., moderate to fresh; sky usually cloudy; relative humidity less than in November. Bar. pressure below, and mean temp. above the average.

QUINISH.—Curiously mild and genial month.

BRAEMAR.—23rd, T and L; a very severe, wet month; the largest quantity of S since 1838.

ABERDEEN.—Bar. pressure below the mean; mean temp. 2° above the average; rainfall 8·87 in. or 5·68 in. above the average of 20 years, and as far as we can trust our records, above the fall in any month of the last 48 years. Prevailing wind S.E. and E. Estimated amount of sunshine for the whole month 27 hours; R 335 hours. 23rd, T and L at 3 p.m., 11 p.m., and 12 p.m.; L at 6.8 p.m., with H and sleet.

LOCHBROOM.—This peculiar month has terminated with one of the severest and most disastrous storms that has been experienced here for years; the first six days were changeable, then followed 12 very fine days, but after that such weather of every degree and variety (except good) as is seldom seen.

PORTREE.—A very fine open month; frosty from 20th to 29th; S from 20th

to 28th; a heavy gale from S.E. on 5th. The rainfall for this month is more than 7 inches below the average of the last 16 years.

**CULLODEN.**—1st, very distinct lunar halo; bar. 28·365 in. (corrected to 32°) on the 4th; 11th, aurora in an arch over N. horizon; frequent S after the 18th.

**SANDWICK.**—Wind 50 miles an hour from 10 a.m. on 3rd to 10 p.m. on 4th, and 40 miles an hour till midnight; faint aurora 10th; S 22nd, 23rd and 24th; wind 50 miles an hour, at one time 58 miles. December has been cold, wet and stormy; the B 1·70 in. above the mean; S showers from 19th to 24th inclusive, much of which still blocking up the roads, and a fresh fall on 31st. There were gales of wind from 50 to 58 miles an hour on 3rd and 4th, and on 22nd, 23rd and 24th, that which continued from 22nd to 24th was the strongest gale of E.S.E. that I recollect in the way of wrecks.

#### IRELAND.

**DARRYNANE.**—A wet month, but for the most part very mild; 20th to 25th, both included, were, however, cold, and E. wind; H and S on 22nd and 23rd, and slight S on 25th; shower of H before day-light on 22nd, some of the stones found at 11 a.m. were fully half-an-inch diameter; heavy gale from S.W., with a tremendous sea and very high tide, during the night of the 30th and morning of 31st; 3·60 in. of R fell on the five days, 15th to 19th inclusive. The wettest year since 1872.

**KILLALOE.**—23rd, heavy fall of S.

**MONKSTOWN.**—26th, strong gale from E.S.S. The wettest month I have ever recorded; total fall 8·50 in., or nearly 6 inches above the average; evening of 27th remarkably warm, ther. standing at 53° at 6 p.m., with a perfectly clear sky.

**BALLYSHANNON.**—The close of 1876 has been marked by unusually heavy rainfall in this locality. On 24th a fall of S, which almost immediately disappeared. There have been several high tides during the month, and the river Erne is greatly swollen.

**WARINGSTOWN.**—Almost incessantly wet and generally mild. We did not feel the E. gales here as much as reported elsewhere.

**EDENFELL, OMAGH.**—A mild but remarkably wet month; R or melted S having on three days exceeded an inch, and the total fall (7·67 in.) being the greatest of any month during 12 years. A very characteristic day for Christmas, as it was frosty, with S on the ground.

### BOOKS RECEIVED.

#### ENGLAND.

**GILBERT, DR. J. H., F.R.S.**—On some points in connection with vegetation. 8vo.

„ „ Sewage Utilization (from Minutes of the Institution of Civil Engineers). 8vo. 1876.

**Meteorological Committee.**—Report for the year ending 31st December, 1875. 8vo. 1876.

„ „ Observations at Stations of the second order. 4to. 1876.

„ „ Report of the Permanent Committee of the First International Congress at Vienna. Meeting at London, 1876. 8vo. 1876.

**First Report of the Committee on the Meteorology of Devonshire** (reprinted from the Trans. of the Devonshire Association for the Advancement of Science. 8vo.

**Fourth Report of the Leicester Museum Committee to the Town Council, to March 31, 1876.** 8vo.

**Report of the Council of the Leicester Literary and Philosophical Society.** Presented at the Meeting on June 19, 1876. 8vo.

**ROBINSON, T. R., D.D., F.R.S.**—Reduction of Anemograms taken at the Armagh Observatory, in the years 1857-63, (from the Phil. Trans. of the Royal Society of London). 4to.

**SILVER, S. W.**—Handbook to South Africa. 2nd edition. Small 8vo. 1876.