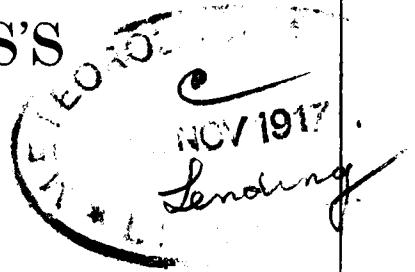


SYMONS'S

MONTHLY



METEOROLOGICAL
MAGAZINE.

VOLUME THE ELEVENTH.

~~~~~  
1876.  
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AND ALL BOOKSELLERS.

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CXXI.]

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SUNLIGHT.

ALTHOUGH the last few years have witnessed a rapid succession of improvements in the means of measuring the heating power of the sun's rays, and the measurement of their chemical action has not been neglected, we are inclined to believe that the work now before us* will eventually be regarded as one of the most important contributions towards the solution of many problems respecting agriculture and sanitation which at present are beyond the limits even of conjecture.

We cannot in this review do more than bring the subject and the book to the notice of our readers; it is written in M. Marchand's usual lucid style, and though it extends to more than 200 pages, we think that few who begin it will leave it unfinished.

Instead of introducing the subject ourselves we will let M. Marchand do so; although perhaps the language may lose by translation, we shall rigidly preserve the sequence of ideas.

INTRODUCTION.

"Every one knows that the light which the sun scatters through the realms of space is not by any means a homogeneous principle, the prism decomposes it into coloured rays, of which we have a faithful picture in the rainbow, and into invisible rays which are only appreciable through the physical or chemical properties which they possess. The first series reunited constitute again the powerful illuminating white light. The second series are subdivisible into two very distinct groups—one subseries possesses heating properties which, while scarcely sensible in the violet portion of the spectrum, acquires an intensity more and more easily measureable as one advances towards the red end of the spectrum, and attains its maximum effect in the unilluminated space beyond the red extremity of the spectrum. The other subseries, on the contrary, are endowed with a very energetic power of setting in motion the atoms of matter, and giving rise to those phenomena of

* Étude sur la force chimique contenue dans la lumière du Soleil, la mesure de sa puissance et la détermination des climats qu'elle caractérise, par E. Marchand, Pharmacien, etc. Paris: Gauthier-Villars. 8vo., 1874. [The preface bears date March, 1875.]

combination and separation which are the study of the chemist ; and they have for this reason been called the CHEMICAL RAYS."

"It is usual to call this chemical action of light ACTINISM ! This is not a suitable term ; derived from *ακτινος* it only expresses the radiating force of the sun considered with regard to its illuminating power. I propose its retention for that purpose only, and to designate the chemical power of the solar rays by the word 'ANTITUPIC,' French synonym of *αντιτυπια* it signifies *reactionary power*, and in order to define more rigorously the force whence it is derived I designate it throughout this memoir by the term '*Photantitupic*,' as I shall call the action of measuring its power '*Photantitupimétrie*.'""

"This Antitupic power varies in each part of the spectrum, with the nature of the elements submitted to it, but on the whole its distribution may be regarded as the reverse of that of the heating rays. It is sometimes perceptible even in the red rays, and presents there quite a remarkable power when acting upon certain substances, but usually it is in the blue or violet rays that it attains its greatest force. It often extends even beyond the violet into the grey-lavender rays, first recognised by Sir J. Herschel and afterwards by many other observers, and into the entirely unilluminated space beyond them."

"In order to complete this brief and rapid exposition, it is desirable to mention also that lately M. Edmond Becquerel has pointed out the existence in solar light of two other species of rays which he has designated *continuators* and *phosphorogenic*. The latter, which extend from the indigo to beyond the violet possess the property of rendering various bodies, among others sulphide of Barium, luminous in the dark. The former, which are coloured, especially yellow, orange, and red, do not exercise by themselves, according to M. Becquerel, any direct chemical action, but he says they possess under certain conditions the remarkable property of continuing the development of this action when it has been commenced. We shall have occasion subsequently to refer to the mode of action of these two species of rays, and the value of the distinction thus drawn between them."

"To epitomize : the sunlight on reaching the earth's surface consists of an assembly of variously refrangible rays, of which some possess lighting, some heating, and some chemical properties. Let us add finally, for it is worthy of notice, that if the heating rays are deprived of chemical properties, the red part of the spectrum still possesses the power of annihilating the reactions produced in the violet portion, *it even sometimes reverses them*. Thus, for example, white gum Guaiacum becomes oxydized when exposed to the air, and of a blue colour when exposed to the violet rays, but if when so tinted it is placed in the red rays it becomes blanched, as Wollaston first showed at the beginning of this century. Thus also a sensitized Daguerreotype plate, of which the

* Although we share M. Marchand's views respecting the desirability of removing the anomaly of designating the chemical rays Actinic, and the word Actinometry is not short, we fear there is little chance for Photantitupimetry—seven syllable words do not thrive on English soil.

surface is submitted to the action of weak solar light, undergoes different changes, according to the portion of the spectrum allowed to fall upon it, and in part of the blue, as well as in the indigo and violet rays, it takes that deep olive tint, which is always produced by prolonged exposure to strong white light, whether direct or diffused. On the contrary, the same surface exposed to the other portion (the red end) of the spectrum remains unaffected, or if previously tinted by exposure to the violet rays, it is speedily restored to its primitive state, that is to say the action previously exerted is destroyed. M. J. Draper, to whom we are indebted for this curious observation, has found moreover that the less refrangible rays, preserve from the action of the more refrangible rays impressionable substances exposed to them."

"By the threefold action above mentioned the solar rays have an important influence on climatology, they illuminate our earth and its atmosphere, and spread over its surface this heating and antitropical power, without which, matter would remain inert, and the world would be lifeless. The illuminating power of light is an important natural agent, but it is not the quality which exercises the most potent influence on all those marvellous phenomena which science studies, and whereof, little by little, and with great labour, it discovers the immutable laws. In fact, as an illuminating agent, light is not absolutely necessary to the support of life—at least of animal life—and it only plays a secondary part in meteorology. It is especially through the heating and chemical rays by which it is accompanied that it exerts so marvellous a power. When unassisted by these rays it is powerless to affect even the most delicate thermometer, or to effect the slightest change in the molecular arrangement even of substances the most sensitive to the action of the chemical rays; it is then even powerless to assist the growth of plants, which only results from the fixation of the carbon which they borrow from the carbonic acid diffused in the atmosphere wherein they live.

The sun, centre of the great planetary system, sheds in every direction, as the result of the violent conflagrations of which it is the scene, sheaves of threefold rays, but these rays may reach the earth deprived of both heating and chemical power, if they come to us reflected from an opaque body. Of this a striking illustration is afforded by the light reflected to us by the moon, which, though readily decomposed into coloured rays by the prism, possesses neither heating nor chemical power,* and is also without appreciable influence upon vegetation."

"As an illuminating power the light emanating from the sun undoubtedly deserves to be treated from a meteorological point of view,

* M. Marchand gives here a long note which we must abridge into a few lines. He begins by saying that this statement is not rigorously exact; of the existence in moonlight of chemical rays we have proof in the possibility of taking excellent photographs of the moon, and M. Marié-Davy has obtained indications of heat-rays by a thermo-pile, placed in the focus of a 9-in. equatorial. As, however, the heat thus indicated was only $0^{\circ}000022$ F. or $\frac{1}{45000}$ th of a degree F., we hardly need concern ourselves with its effects.

but its absorption by the media which it traverses, and its interception by the clouds and vapour of the atmosphere is such as to render it difficult even in the course of a single day to make observations with sufficient frequency to obtain trustworthy mean values. In this respect we shall state further on the results obtained by Bouguer, but under ordinary circumstances all that can be done as regards meteorology is to estimate approximately the amount of cloud."

M. Marchand then states his mode of estimating the amount of cloud, the hours at which he observed it, the mean amount for each month of twenty years 1853-72, and remarks upon the conclusions to be drawn from them.

The author then proceeds to explain the different modes adopted for measuring the total chemical energy of the rays reaching the earth's surface, by Draper, Niepce de St. Victor, Roussin, Bunsen and Roscoe, and Edmond Becquerel. He then describes fully his own method, and the very important conclusions to which his elaborate and long continued observations lead. For all these details, however, we refer our readers to the work itself, and we promise them a varied intellectual treat in its perusal. As a proof of the variety, we may conclude by mentioning two or three points which arise from the investigation, *e.g.*, the question of the height to which the earth's atmosphere extends, that of an open polar sea, and of the total solar energy.

OBSERVATIONS OF CIRRUS.

To the Editor of the Meteorological Magazine.

SIR,—I believe that synoptic observations of the upper currents throw much light on the general laws by which the surface currents of our atmosphere are regulated. Foreign observers are prosecuting this research with vigour. In our islands, I believe I am correct in saying, there are not 15 observers who record separately the motions of the Cirrus. May I, through your columns, implore assistance in this work? If any observers who have not hitherto contributed observations of Cirrus, are ready to undertake the task, they may possibly welcome a few suggestions from one who has worked at it steadily for very many years.

1st, As to locality. Observations are wanted *everywhere*. The accidents of a cloudy sky, fog, &c., often prevent an observation at one station, when it can be made at a neighbouring one. But observers are especially required in the extreme S.W. and N.W. of the British Isles, and in the N.W. of France.

2nd, As to time. Many observers are so wedded to regular hours, that they will not, except at such hours, make observations of upper currents. I have found that a diligent observer, favourably situated, who observes the motions of Cirrus whenever possible, makes them on an average upon 230 days annually. Another observer, who observes for me twice a day, at 8 a.m. and 2 p.m., can make them on 85 days only. It must be remembered, too, that absolute synchronism is of

far less importance in observations of the upper currents than in those of the surface winds, because the changes in the direction of the former are far fewer, and take place on a grander scale than those of the latter.

3rd, As to the mode of observation. It seems hardly necessary to say, that in watching the motions of Cirrus, the observer must be perfectly stationary, and should have some stationary object, such as the corner of a roof, a church spire, or the like, nearly in the line of vision; but I have seen numerous mistakes made from the neglect of this latter precaution, when several layers of clouds are crossing each other.

4th, As to the clouds observed. Let Cirro-cumulus be entered separately from Cirrus. And if there be a particle of doubt as to the type of the cloud observed, let the observation be recorded with a note of interrogation.

I shall be glad to supply printed forms of entry to any persons who may be ready to give their assistance by taking observations, and I ought perhaps to mention, that copies of all Cirrus observations obtained by me are forwarded to Upsala, but if any observers who wish to use my forms already transmit observations on the Upsala forms, I trust that they will continue to do so, as I wish to supplement, and not to interfere with, Hildebrandsson's important enterprise.

Yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, January 13th, 1876.

P.S.—I imagined (vainly, as now appears from Mr. Birt's letter) that in speaking of the "directions of the movements" of Cirri, I could only be understood to mean "the directions from which they move," and I intentionally omitted all allusion to the position of their streaks or bands on the sky. I am glad, however, that Mr. Birt has directed attention to this latter element, as it is undoubtedly of some, though of inferior, importance. In the forms for entry above mentioned, a column is devoted to it. I have nearly prepared for publication a table of the positions of "Polarization," in the observations of the last decade, and of the relations which these bear to the direction of movement.

For my own part, I have never been able to trace any more connection between the positions of the lines of Cirrus and magnetic or auroral manifestations, than between the latter and the positions of the isobars on an ordinary weather chart. I have before me some synoptic maps of the positions or arrangement of the lines of Cirrus, and also of the directions of the currents in which the Cirri travelled. The latter exhibit every kind of variation of the anti-cyclonic, and of the cyclonic type. I take one of the last-mentioned, that for July 12th, 1875. From Valencia to our east coast there existed a uniform upper current from N.W., and the lines or belts of Cirrus stretched from N.N.W. to S.S.E. In France the upper current was from W.

and W.N.W. ; the position of the belts I do not know. In Austria from W.S.W. ; belts stretching from W.S.W. to E.N.E. At the entrance of the Baltic the Cirri moved from W.S.W., and in Scandinavia from S.W., the belts stretching from S.W. and S.S.W. to N.E. and N.N.E. A relation of dependence is here traceable between the form of the belts and the directions of movement. A relation may also be noticed between the directions of movement and the distribution of pressures and winds at the earth's surface. But can anyone find, not an association of ideas, but a real relation, between the "polarization" of the Cirri on that day, and the magnetic and electric elements? If he can, he will have discovered a skeleton-key to half the problems of meteorology—a "sesame" for its most hidden treasures.

W. C. L.

January 19th.

SNOW MEASUREMENT.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to see by your last issue that this question is likely to be further discussed. At present the results are, I fear, not trustworthy.

As a small contribution, I send you the following figures, shewing the results of my efforts to measure the snowfall in December last.

The four gauges, A, B, C, D, stand at the four corners of a square of 5ft. 6in., each is 5in. in diameter, 1ft. above the ground, and 433 ft. above sea level. A is a gauge of ordinary pattern ; B is likewise of ordinary pattern so far as the funnel is concerned, but the receiving bottle is placed underground ; C is a Snowdon pattern ; D is a Snowdon pattern with the bottle underground.

DATE.	A	B	C	D	Miles of Wind.
November 30	·015	·010	·010	·010	170
December 1	·005	·005	·015	·010	160
„ 2	·400	·390	·455	·456	67
„ 3	·005	·005	·005	·005	58
„ 4	·025	·020	·020	·020	80
„ 5	·110	·115	·140	·100	145
„ 6	·015	·015	·010	·020	158

On the 2nd December the snow was about 8in. deep on the ground. It had filled the funnels, and then was piled up in a bunch to windward, being supported by a buttress of snow resting against the outside of the gauge. How much ought to have gone into the gauges I could not tell, but in order to measure I cut down through the bunch straight with the edge of the gauge and melted what was in and over the funnel ; the result was that the deepest funnels had most snow. This, however, was not the case on the 5th, but why D had less than any of the others I can't tell.

Since then I have made an attempt at a snow gauge in the form of a

cylinder, 18in. deep, 5in. diameter, set 6in. in the ground in the middle of the square with, so far, the following results.

Date.	A	B	C	D	Snow gauge.	Wind.
January 8 ...	·040	·040	·050	·040	·050	283
„ 13 ...	·110	·075	·130	·115	·150	93

I don't much believe in measuring the depth of the snow on the ground ; generally a great deal melts before the snow begins to lie.

The question seems worth discussion. I hope some of your readers in more snowy districts will be able and willing to help.

I am, &c.,

EDWARD E. DYMOND, F.M.S.

REMARKABLE PHENOMENON.

To the Editor of the Meteorological Magazine.

SIR,—I think the extraordinary circumstance I am about to relate will excuse me for intruding on you.

On Sunday morning, January 23rd, the sea in Rye Bay was frozen over. The ice was a quarter of an inch thick for three or four miles out. The temperature inland was by no means cold.

The local paper states :—“ A Phenomenon.—Early on Sunday morning last Rye Bay presented an unusual and singular appearance, being covered with an unbroken sheet of ice, almost an eighth of an inch in thickness, for more than three miles out at sea.

Several boats which, were out, experienced a difficulty in making their way through it, and the cold was intense. Within the memory of some of the oldest sea-faring men such a circumstance has not been witnessed before.”

I see the paragraph says only an eighth of an inch ; the sailors told me a quarter.—I am, &c.

E. B. CURTEIS.

Leasan, near Rye, February 3rd.

OZONE.

To the Editor of the Meteorological Magazine.

SIR,—A letter in your magazine of January, 1876, from the pen of Dr. Palmer, of Tipperary, Ireland, on “ Ozone at 6,000 feet above sea level,” has attracted my notice, on account of the most complete unacquaintance therein displayed with all the results of the years of toil of those who have made the study of atmospheric ozone *the* pursuit of their lives. Dr. Palmer exposes starch tests in the old fashioned cages, and speaks of his observations made in this way as “ trustworthy,” and then adds, “ For the striking inequality of the results, I attempt no explanation.” I should not have noticed this letter, but that greater men than Dr. Palmer have recently similarly distinguished (?) themselves. I observed an abstract of a paper by Professor Pettenkoffer, of Munich, in the “ Centralblatt für Agrikultur 'Chemie,” of April, 1875, in which this eminent man seems to have *only now* discovered

that the depth of colour of the so-called ozone tests has much to do with the force of the wind ! There is some excuse for the Professor, because he is a foreigner, but there can be no reason why an Irishman should write as if in perfect ignorance of everything that has been written on the subject of ozone for many years past.

I hope that Dr. Palmer will not consider that the foregoing is written in an unkind spirit. It is not intended to be so. It is really, however, most disheartening to me, that a professional brother should write in so verdant a manner.

I am, Sir, yours respectfully,

CORNELIUS B. FOX, M.D., F.M.S.

Chelmsford, Essex, January, 1876.

PREVALENT WINDS.

To the Editor of the Meteorological Magazine.

SIR,—Amongst the many and varied observations of your widely-spread correspondents, there are but few that take up the subject of the direction in which the wind blows, leaving that matter, I presume, in the hands of the sea-going class alone. But there is assuredly no reason for this ; for although it may not exercise so important an influence on land as it does at sea, it is unquestionably a very powerful agent for good or evil, in the one as well as the other, and in the rural districts, at least, it forms the principal guide the residents have to the coming weather, and a long period of observation has enabled them in a general way to judge tolerably accurately, for a few hours at least, what meteorological changes, if any, are likely to happen. But it is not my purpose to advert to this matter, but to point out in which way the winds of the past year have differed from the averages of the preceding 26 seasons in which the direction the wind was blowing at noon each day was recorded. At the same time, it is only fair to say, that only the eight cardinal points are taken, and in the observations, the nearest approach to any one of them was read as being such :—

	Total No. days in all.		Yearly average.	Record of 1875.
East wind.....	431	being an average	... 16·6	... 16
S.E. „	825	„	... 31·7	... 32
S. „	1399	„	... 53·9	... 87
S.W. „	2151	„	... 82·7	... 51
W. „	1108	„	... 42·6	... 38
N.W. „	870	„	... 33·5	... 18
N. „	1082	„	... 41·6	... 63
N.E. „	1560	„	... 60·0	... 57
Not ascertained or changeable	70	„	... 2·7	... 3

From the above it will be seen that the N. and S. winds have been more prevalent the past year than usual, and the S.W. and N.W. fewer, the others not remarkable. But on looking, during the past year, over the table giving the figures for each year, it was easy to discern that the prevalence of N.E. winds indicates a dry season. For instance, I find as many as 115 days are noted as having N.E. winds in 1855, when the rainfall of the year was under 21 in. In like manner, 87, 71, and 79 days are recorded for 1858, 1864, and 1870, respectively, all being dry years ; but it is also remarkable that some

of the heaviest rains we have had have been with the wind in that direction, thus verifying the saying of the district, that when it does rain with a N.E., "it does not half do it." But in a general way, the S.E., S., and S.W. winds, bring most rain, the last named being also generally the highest, while, on the other hand, we certainly have fewer due E. winds than are met with elsewhere. On this head, however, I would like to have the records from other places, as the subject is certainly as well deserving of study as some of the abstract ones into which meteorology seems to be divided.

JOHN ROBSON.

Linton Park, Maidstone.

UNDERGROUND THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I was pleased to see the subject of underground temperature brought forward in your last Magazine, for, as you say, there are very few instruments in this country for determining the temperature of the soil, and what there are, will undoubtedly bear improvement.

The form of instrument you propose has many advantages over the old pattern, which has practically a limit to its length, both in making and planting, while the tube you describe, might I suppose easily be driven to any depth by an application of the apparatus used for sinking tube-wells without any fear of damage; but on reading your paper it occurred to me, that if the instrument were used for depths of more than five feet, the long wooden rod would be rather awkward, and that reading might be facilitated by having the thermometer mounted in about a foot or eighteen inches of rod, and suspended from the cap by a chain.

I do not quite understand the nature of the cotton plug above the thermometer, but if air-tight (and it would be useless unless it were so) the pressure of the air would make it rather difficult to raise the thermometer. Would it not be practicable to have a plug that would only act when the thermometer was at rest? for instance, on the top of the thermometer fix a plate of wood or metal, nearly fitting the pipe, on which fasten a pear-shaped wash-leather bag, partly filled with mercury; when the thermometer was at the bottom and the chain slack, the bag would swell out and fill the tube, but when the chain attached to the top of the bag was pulled, the bag would elongate and rise without any difficulty. These suggestions of course apply only to deep underground thermometers, but for any length less than five feet the thermometer as you describe it, is vastly superior to the old form; it can be read with any degree of accuracy of which the instrument is capable, without the very unpleasant task of putting your face on the ground, and from its great simplicity should, I think, be much cheaper than the instrument now in use, besides being decidedly more durable.—Yours faithfully,

H. S. WALLIS.

1, Springfield-road, N.W., Feb. 3rd, 1876.

KEW VERIFICATION.

NOTICE.

The Kew Committee of the Royal Society give notice that in order to afford to the public greater facilities for the verification of instruments at Kew than have hitherto existed, they are prepared to undertake the transport of instruments, &c., from London to Kew and back, free of charge.

With this object they have made arrangements for Mr. R. Strachan, of the Meteorological Office, 116, Victoria Street, to receive at that office any instruments intended for verification.

As soon as the instruments have been verified and are returned to London, notice will be sent from Kew to the parties concerned.

By order of the Committee,
ROBERT H. SCOTT, *Hon. Sec.*

Kew Observatory, Jan. 29th, 1876.

[The above circular has been sent to some of our contemporaries as an advertisement, but not to us ; as, however, our interest in the progress of meteorology is far greater than our desire to accumulate £ s. d., and we believe that the new arrangement is a good one, we present the Kew Committee, not with a gratuitous advertisement, but with prominent insertion. Moreover, we desire to impress upon our readers the opinion which we entertain, that it is very unwise for those who devote their time to meteorological observations to risk wasting all their labour, and leading to the dissemination of error, by using unverified instruments. Hitherto the danger, and the time occupied, in sending instruments to and from Kew, has been a somewhat unfair tax upon the opticians. This difficulty is swept away by the new arrangement, and we trust that henceforth the influence of the manufacturers will be exerted in support of the purchase of verified instruments ; in fact, probably the maker who announced that all his instruments were verified, would secure a priority with many observers. No one would think of buying gold or silver without the Hall Mark ; we hope to see the day when no one who claims to be considered a meteorological observer will use an unverified thermometer. We therefore hope that not only will the arrangement now announced succeed, but that it will soon be found desirable to organize a branch establishment in London and thereby avoid sending to Kew at all, except in rare instances.]—Ed.

FINE DAYLIGHT METEOR.

Bombay, December 17th.—On the 11th of December, Her Majesty's ship "Crocodyl" was in latitude, 13° 30' N. ; longitude 52° 30' E., about 2 days from Aden, and about 5.45 p.m., a most extraordinary phenomenon made its appearance in the sky. The sun was setting at the time, and the smoke of a Peninsular and Oriental steamer, we had lately passed, was disappearing in the west, when almost instantaneously a band or streak of light appeared in the heavens, about 15° above the horizon, and 30° north of W., it extended upwards some 25°, in a zig-zag form, like a quaint signature written on the sky, in magnesium light, and looking at it sideways, it seemed to form roughly the letters "ANHIRTY." The streak at its lower extremity was 1½ ft. broad, getting thinner as it approached the zenith. It did not seem to keep quite still, but to creep out sideways as do the

beams of an aurora borealis. The sunset was most beautiful at the time, or rather the sun had just disappeared below the horizon in orange and greenish-gold tints, but this trail, though, like burnished steel or the sheen of tar spilt on water, with its purplish tints, was too uncommon and uncanny to strike one as beautiful. It shone till darkness enveloped it—viz., for some ten or fifteen minutes. No one on board the “Crocodile” had ever seen anything like it before, and many were the conjectures as to its cause. Some attributed it to electricity; some said it was a sort of dust carried up from the desert, suspended at such an angle that the sun’s rays suddenly impinging on it gave it the appearance I have described. The wags said it was the mirage of the trail of the great sea serpent. Any way it was a most remarkable sight, and one that will never be forgotten by those who had the good luck to see it.

December 20th.—The Peninsular and Oriental steamer “Gwalior,” Commander Babot, arrived here on the 18th, having experienced bad weather in the Bay of Biscay, which caused her to be two days late. When two days from Aden her people also were astonished by the sight of a huge meteor, which they describe as coming through the sky like a ball of fire, the size of the sun, throwing out sparks that it appeared to hit and to throw up the water, whence they consider it was within seven miles of them when it fell. It left a luminous trail behind, which at first was straight but gradually took a zig-zag form, and no doubt it was this we saw in the “Crocodile.” They all talk of its wondrous appearance.—*Morning Post*, January 10th, 1876.

SUPPLEMENTARY TABLE OF RAINFALL IN JAN., 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	·89	Llanfrechfa	2·77
Hailsham	·61	Castle Malgwyn	2·32
Andover.....	1·70	Heyope	1·89
Strathfield Turgiss	·89	Rhug, Corwen.....	1·21
Addington Manor	2·02	Port Madoc	2·47
Oxford	1·68	Melrose	·86
Cambridge.....	2·03	Cessnock, Glasgow	3·39
Sheering	1·06	Gruinart .....	...
Ipswich	1·11	Keith	1·02
Diss	2·44	Strathconan	4·49
Swaffham	1·85	Springfield, Tain	·96
Compton Bassett	2·43	Skibbereen	2·61
Hessary Tor, Dartmoor..	3·70	Glenville, Fermoy	3·44
Teignmouth	1·07	Tralee.....	3·03
Torrington.....	1·88	Newcastle, W. Limerick	1·13
Trevarrick, St. Austell..	1·42	Kilrush .....	...
Taunton	·90	Kilkenny	·93
Bristol .....	...	Twyford, Athlone	1·68
Sansaw	1·93	Kilsallaghan	·60
Cheadle	1·69	Ballinasloe	1·77
Ashby-de-la-Zouch	1·87	Kylemore	9·66
Coston, Melton Mowbray	1·54	Bangor	5·37
Bucknall	1·66	Carrick on Shannon.....	2·19
Walton, Liverpool	·89	Rockcorry	1·65
Broughton-in-Furness ..	3·87	Warrenpoint	2·26
Stanley, Wakefield	·84	Bushmills	1·67
Gainford	·31	Buncrana	2·19
Shap	4·15		

REVIEW.

The Theory of the Causes by which Storms Progress in an Easterly Direction over the British Isles, and why the Barometer does not always indicate real vertical pressure. By ROBERT TENNENT, ESQ.—
From the *Proceedings of the Royal Society of Edinburgh*, July 5th, 1875.

THE laws of storms find in Mr. Tennent a radical reformer, without mistake. While the majority of meteorologists who have dealt with the subject regard surface friction as an element of retardation to the progress of storms, the theory is advanced in this paper, that the progress itself is the result of surface friction. This theory may be summarised as follows :—

When a barometric depression is formed, it will tend to move forward in the direction in which the supply of air is most scarce, and by doing so will be able to procure the necessary amount of supply. The equatorial currents which in our latitudes occupy the front segment of the depression, have a horizontal source of supply, and having been drawn from a long distance over the earth's surface, are subject to great retardation from the inequalities of that surface. The polar currents in the rear derive their supply from a vertical source, and are fed by upper currents, whose motion is impeded only by the comparatively unimportant friction of the subjacent portions of the atmosphere. The depression is in consequence filled up or supplied with difficulty by the equatorial currents in the eastern, and with comparative facility by the polar currents in the western segment. "There are thus two different modes of inflow towards the low central barometer ; one is an advantageous, the other a disadvantageous form. It is by this latter mode that the gradient is lowered. It takes place with inclined columns, resulting from rapid upper and retarded surface currents. Much of the work of inflow is thus thrown upon the uppers. To enable them to maintain their superior velocity, they themselves must be adequately supplied by the uppers in advance. This is accomplished by outward extension ; they advance forward to procure the requisite supply from the still atmosphere ahead, which now begins to inflow spirally. It is to this advancing line of removal that the term, 'curve of outward propagation' is applied. It may be illustrated thus :—If a river, flowing down an incline, does so uniformly and at an equal rate of speed, removal will equal restoration ; but if in the lower part of its course a more rapid removal is inaugurated, while supply above remains as before, the curve representing the point at which the increased removal begins to travel upwards will represent the forward movement of this curve of outward propagation or extension."

On Mr. Tennent's theory, a change of hydrostatic pressure produced at any given point in a fluid previously at rest, will propagate itself most readily in the direction in which the currents established have the greatest surface friction to overcome, a statement which we regard as paradoxical.

From an observational point of view, we think that the author's conclusions are open to some serious objections. In the first place, there is involved the supposition that in the front segment of a depression the *upper* as well as the under currents flow *inwards*, spirally towards the centre, whereas the contrary appears in a large number of cases to have been almost demonstrated by observation. In the second place, since on an oceanic surface the amount of friction is exceedingly small, as compared with that on a land surface, we should expect that, on Mr. Tennent's theory, depressions would be, *ceteris paribus*, much the greatest in the interior of large continents, and comparatively unimportant in mid-ocean; yet we find the reverse to be commonly observed. And lastly, for the same reason, it is difficult to conceive why a depression situated on the east coast of an extensive continent, such, *e.g.*, as that of North America, should ever be found to travel eastwards, if eastward propagation is the result of an excess of surface friction.

The adoption of this theory would necessitate the most sweeping changes in the construction of weather charts. The isobarics are regarded by Mr. Tennent as often absolutely uninterpretable with reference to the real inflow of air. In order to represent the conditions of real pressure, they must be greatly widened out in the front of every depression, so as to be drawn through figures of very unequal observed pressure. Thus the isobar 30.00 in the rear of a depression, where real and observed pressures are supposed nearly to coincide, will have to be widened out in the front of the depression, through localities where a pressure of about 30.20 is observed. The attempt to execute this process will, we believe, indicate to the reader, more effectively than our criticisms, the inaccuracy of the theory; for it will exhibit the reality of the general relation between the gradients of observed pressures, and the directions and velocities of observed winds.

It is indispensable to the author's hypothesis that barometric pressure should be found to be actually less with equatorial, than it is with polar currents. In support of this, Strachan's Paper in the *Proceedings of the Meteorological Society* (misquoted, by the way, as the "English Meteorological Magazine") for June, 1869, is referred to. "Not proven," is all that we can say of this assumption. The common assertion that "the barometer falls lowest in S.W. gales," is true only in a modified sense, and as an accident of geographical position. An actual barometric minimum is invariably accompanied by a calm; but as the track of depression centres is ordinarily to the N.W. of our islands, and generally on the polar side of districts in the temperate zones, our barometric oscillations are commonly greatest with equatorial winds. At Stykkisholm, where the track is ordinarily on the S. and E., the lowest barometer is commonly observed with polar winds.

While dissenting, however, from Mr. Tennent's conclusions, we welcome every attempt to grapple fairly with questions which are confessedly among the most important, as well as the most intricate, in general meteorology.

Z.

JANUARY, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which '01 or more fell.	Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
											inches.	in.	
I.	Camden Town	·94	— 1·01	·32	21	11	54·8	31	18·9	12	17	21	
II.	Maidstone (Linton Park)	1·24	— ·82	·27	22	15	57·0	31	17·0	9	...	...
III.	Selborne (The Wakes)	1·43	— 1·84	·26	21	12	51·0	3	21·0	19	14	18	
IV.	Hitchen	1·86	— ·28	·92	21	11	49·0	3	15·0	11	23	...	
V.	Banbury	1·73	— ·36	·65	21	11	51·5	3	20·0	16	20	...	
VI.	Bury St. Edmunds (Culford)	1·80	— ·07	·83	21	12	53·0	31	21·0	8	20	25	
VII.	Sproston	2·04	...	1·09	21	12	...	...	...	...	...	...
VIII.	Bridport	1·38	— 1·71	·32	13	10	...	...	...	...	...	...
IX.	Barnstaple	2·13	— 1·39	·67	20	11	55·5	4	29·0	8	...	...
X.	Bodmin	1·62	— 3·57	·46	20	15	55·0	3	25·0	10†	9	13	
XI.	Cirencester	2·46	— ·54	1·18	21	6	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	1·60	— ·30	·79	20	6	51·0	31	17·0	12	19	24	
XIII.	Tenbury (Orleton)	2·34	— ·19	·92	20	12	53·7	3	19·5	12	18	20	
XIV.	Leicester (Belmont Villas)	1·87	...	·73	21	12	53·0	31	16·5	12	17	...	
XV.	Boston	1·82	+ ·11	·80	21	9	53·0	3	20·0	16	16	...	
XVI.	Grimsby (Killingholme)	1·39	...	·40	20	13	52·0	31	26·0	9†	10	...	
XVII.	Mansfield	1·33	...	·46	21	8	53·5	31	15·8	8	16	...	
XVIII.	Manchester	1·74	— ·78	·70	20	9	52·5	31	23·0	12	15	20	
XIX.	York	1·02	— ·56	·31	12	8	...	...	...	...	...	...
XX.	Skipton (Arncliffe)	2·83	— 2·81	·81	19	17	52·0	31	16·0	8	20	...	
XXI.	North Shields	·70	— 1·41	·20	12	10	52·2	31	25·0	9	11	21	
XXII.	Borrowdale (Seathwaite)	10·91	— 5·45	2·87	22	16	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	3·12	— 1·93	1·00	20	10	52·0	31	22·5	8	12	16	
XXV.	Machynlleth	3·26	...	·85	20	13	...	...	...	...	...	...
XXVI.	Llandudno	1·19	— 1·35	·55	20	6	55·0	28	22·2	9	...	...
XXVII.	Dumfries (Crichton Asylum)	1·86	— 2·33	·30	22	17	50·4	24	15·7	11	15	17	
XXVIII.	Hawick (Silverbut Hall)	1·20	...	·44	19	13	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill)	1·70	...	·34	19	21	54·0	4	23·0	9,10	11	16	
XXX.	Castle Toward	3·49	— 2·80	·45	22	20	52·0	19	20·0	10	12	...	
XXXI.	Quinish	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Balfour	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	2·09	...	70·	19	12	...	...	...	...	...	...
XXXIV.	Braemar	1·61	— 1·52	·57	19	15	50·0	31	13·8	14	12	24	
XXXV.	Aberdeen	1·14	...	·27	3	12	51·5	31	22·5	9	11	16	
XXXVI.	Loch Broom	4·46	...	·72	22	22	...	...	...	...	...	...
XXXVII.	Portree	11·87	— 1·22	1·83	27	27	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	·88	— 1·40	·36	24	19	53·0	31	21·1	10	8	19	
XXXIX.	Helmsdale	1·39	...	·30	18	18	...	...	...	...	...	...
XL.	Sandwick	2·92	— ·37	·38	19	22	51·2	24	26·4	10	3	8	
XLI.	Caherciveen Darrynane Abbey	3·33	...	·83	29	17	...	...	...	...	...	...
XLII.	Cork	2·61	...	·65	29	19	...	...	...	...	...	...
XLIII.	Waterford	2·24	— 2·62	·61	29	17	52·0	2	26	10	...	...
XLIV.	Killaloe	...	...	...	...	...	...	...	...	...	...	...
XLV.	Portarlinton	1·13	— 2·88	·25	30	21	55·0	4	23·5	8	15	...	
XLVI.	Monkstown, Dublin	·36	— 3·03	·10	29*	9	...	...	...	...	...	...
XLVII.	Galway	2·95	...	·47	27	21	56·0	28	24·0	11	11	...	
XLVIII.	Ballyshannon	1·85	...	·54	19	16	...	...	...	...	...	...
XLIX.	Waringstown	1·25	...	·23	29	17	55·0	3	20·0	13	12	15	
L.	Edenfel (Omagh)	1·44	...	·33	29	14	53·0	3,4	22·0	21	14	0	

* And 16.

† 11.

‡ 12 & 16.

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY.

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.—Wintry from 6th to 17th, the ground being covered with S during that time, which drifted considerably on the 14th, with sharp frosts on 6th, 8th, 9th, 12th, and 16th, yet not remarkably severe, and the remainder of the month mild, the beginning and the end particularly so. Fogs frequent, and but little sunshine. Winds never high, mostly S. and S.E.; on the whole a mild month for January.

SELBORNE.—A very cheerless and foggy month. Fog on 19 days, at times very dense. Prevailing wind first half of the month, N.E., afterwards variable. Blackbird first heard singing on the 4th.

CULFORD.—The weather during the month may be considered as seasonable with perhaps an unusual prevalence of polar or easterly wind. Mean temp. 35·9.

BODMIN.—Mean Bar. 30·28, the highest mean I have ever registered. Mean temp. 42·1. This month and the preceding one have been remarkable for the very small rainfall, much less than I have ever registered during the past 26 years.

SHIFNAL.—After an unusually mild Christmas, the new year opened with slight frost, and although the number of frosty nights is large (19), the intensity was small. Notwithstanding the sudden and vast R fall of the 20th and 21st, amounting to 1·27, this has been the driest January since 1864. The month was remarkable for the amount of fog and mist, accompanied, as usual, by a high bar. and easterly wind. The R on 20th commenced from the S., with drizzle, at 10 a.m., and so on till night, when it changed to N.W. and fell heavily, followed next day by S mixed with it till night, and hard frost on the following day. The fog which came on the 28th was sudden and intense, and lasted all night. Snowdrops peeping on the 24th, and both they and aconites in blossom on 29th. Thistle first heard on the 29th.

ORLETON.—The mean temp. was nearly 1° below the average, and the ther. was at or below 32° on 20 nights; the sky was cloudy; the bar. on the morning of the 15th inst. stood at 30·42 (uncorrected). The deposit in the gauge was chiefly snow and was small except on the 20th and 21st, when small R set in about 8 p.m., on 20th increasing to heavy rain at midnight and continuing till about 6 a.m., on 21st, when it suddenly changed to S in dense flakes, which covered the ground and continued falling thickly till 4 p.m., clearing at 8 p.m.; in the 24 hours 1·82 in. fell. On the hills the S was deep and lodged upon the trees so as to break and uproot many of them. The wind was generally moderate. 13th great darkness and haze from 7 to 9.30 a.m.

LEICESTER.—Great changes of temperature during the month. With the exception of the severe frost on the 11th there were only four nights on which the temp. fell below 28°. Heavy S on the 21st. Very foggy on 27th and 28th.

GRIMSBY.—Aconites in flower on 7th. Thrush first heard on 20th. A month of seasonable weather; never severe; high bar.; and much fog. Vegetation backward than last year. Several pleasant days.

MANSFIELD.—Dull and damp; though little rain has fallen the earth has appeared charged with moisture.

ARNOLIFFE.—With the exception of the 19th, when there was a fall of ·81, I never registered so little in the month of January.

WALES.

HAVERFORDWEST.—S in small quantities on the Precelly range on the 1st, and again on the 21st; no S in the lowlands; one of the finest and driest Januaries, for many years; seasonable frosts with clear skies; the last four days overcasts misty, and damp, with high bar.

LLANDUDNO.—Primroses in the hedges on the 2nd. A crocus gathered on 17th. Mazereon in flower on 18th. S on the distant hills on 22nd, and patches of it up to the 31st. A fine dry month, the last ten days unusually mild for the time of year. No S fell during the month, and rain on six days only. The min. registered 22·2 on the 9th, so far the lowest temp. of the winter.

SCOTLAND.

DUMFRIES.—Rainfall greatly below the average, a fourth only of the fall in last January. Mean temp. the same as last year (40·02). Heavy fall of S on 9th, followed by several days of hard frost; latter part of the month mild but windy.

HAWICK.—A terrible hurricane blew from the W. on the 23rd and 24th, which blew down the gable end of a house in Hawick, and made locomotion very difficult for gentlemen and almost impossible for ladies; the noise made by the wind among the timber in the joiner's yard was tremendous.

CASTLE TOWARD.—Much wind and rain; only very little snow, a sprinkle on the 8th, but frequent falls of sleet. Altogether a stormy month, and not favourable for out-door operations.

ANNANHILL.—Frequent frosts; registered temp. going down on the grass to 32° or under on 16 days; S fell in the middle of the month; L seen on the evening of the 2nd, and aurora on the 11th. Day sky usually cloudy, but some of the evenings cloudless, though in the low grounds fogs appeared frequently with the frosts.

BRAEMAR.—An unusually fine and mild month.

ABERDEEN.—Bar. and mean temp. above the average (19 years), and rainfall greatly below it. A month of mild weather, with frequent high winds and little S.

LOCHBROOM.—Exceedingly like its predecessor, fine and open, the latter part mild and genial, like spring; indeed, the bushes are beginning to bud, and the primroses are in a flourishing state.

PORTREE.—A wet and squally month; a strong gale all day on 23rd; TS at 11.45 p.m. on 19th; lunar halo on 30th; heavy H showers on the 20th, and S on 21st.

CULLODEN.—Slight aurora on the last night of the old year; thick fog on morning of the 6th; lunar halo on 11th; stormy from S.S.W. in evening of 23rd and during the night of 24th; pressure from 16 to 25 lbs. on square foot.

SANDWICK.—January has been drier and warmer than the mean. The ground white with S only on two days. There were five gales of wind, 50 miles an hour or more; that on the 18th was the strongest, being 70 miles an hour for three hours; aurora on 14th, 20th, and 22nd.

IRELAND.

DARRYNANE.—First fortnight dry and easterly winds, the rest of the month foggy and gloomy, but mild, with W. and S.W. winds; frost from 9th to 15th inclusive, and on 21st and 22nd.

MONKSTOWN.—With the exception of May, 1871, when only ·35 fell, this month (·36) is the smallest amount measured here in any month. The month was in general fine and mild, with southerly winds, and the atmosphere moist, yet without R; slight frost occurred on six mornings.

BALLYSHANNON.—The month as a whole has been unusually mild and spring-like, and very favourable for the preparation of the ground for cropping, which will soon begin. The rainfall has been light (1·85), 2·62 in. less than the corresponding month last year.

WARINGSTOWN.—A singularly fine month, with a week or ten days of bright frosty weather, succeeded by a mild dry thaw. Rainfall very much less than I have ever measured before; the average of the last 14 years is 3·32, this month 1·25, being—2·07. The driest January in that period (previously) 1864, 1·55.

OMAGH.—The finest and driest January on record here, and with the exception of occasional intervals of dry frost, may also be called the mildest.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXII.]

MARCH, 1876.

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AN ERRATUM.

It is not, perhaps, every one who, if obliged to acknowledge a serious error would do so in the most prominent manner possible. We, however, are not great worshippers of precedents; we are perfectly conscious that errors do and will creep into every human work, and though we dislike errors more than most people, we object still more to ignoring them, concealing them, or glossing them over.

Moreover, just as it is perfectly true that failures are often more instructive than successes, so are errata frequently useful as beacons to warn others off of places where their precursors have made shipwreck of their work.

We have to notify an error in every number of this Magazine for eight years past, and also in our last number. Ninety-seven errata at once is a sufficiently appalling announcement for a Magazine which prides itself on its accuracy. We are not going to defend ourselves, nor are we about to blame the valued correspondent whose extreme desire for accuracy has led to this catastrophe. We intend merely to state the precise facts, and finally to wind up our narrative, as tales used to do, with the moral—which we present to all, and it is by no means one to be neglected.

In December, 1850, Capt. Liddell, R.N., placed in his garden at Bodmin a contracted-float rain gauge, the receiving surface of which was 2ft. 6in. above the grass on which it was placed. From that time to the present that gauge has been read every day.

In the year 1866 he purchased an ordinary 5in. gauge, which he placed near the old one, but with its receiving surface only 1ft. above the ground. In 1868 we asked Captain Liddell, who was one of the earliest contributors to Mr. Symons' *British Rainfall* (Bodmin being one of the 167 stations quoted in the leaflet for 1860) to supply monthly returns for insertion in this Magazine; he consented, and has been one of our most punctual and accurate correspondents ever since.

Now, herein lies the source of our ninety-seven errata—Captain Liddell knowing that an altitude above ground of 1ft. was more usual than one of 2ft. 6in., and moreover that the contracted-float gauges were in less general use than his new gauge, sent the records of the latter. We, on the other hand, assumed that he was still using and sending

Rainfall at Bodmin, 1863-75, by 8 in. float rain gauge, compared with the average by the same gauge during the years 1860-65 inclusive.

Months.	1868		1869		1870		1871		1872		1873		1874		1875	
	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.	Total fall.	Diff. from average.
January.	6.48	+1.29	7.02	+1.83	4.16	-1.03	4.82	-.37	9.73	+4.54	8.06	+2.87	5.70	+5.1	10.84	+5.65
February.	2.37	-.42	4.56	+1.77	5.37	+2.58	3.66	+.87	9.02	+6.23	4.70	+1.91	5.22	+2.43	1.71	-1.08
March ...	3.38	-.37	2.76	-.99	2.79	-.96	1.80	-1.95	5.25	+1.50	4.33	+.58	2.03	-1.72	1.80	-1.95
April ..	3.85	+2.15	1.49	-.21	.30	-1.40	5.64	+3.94	4.36	+2.66	.64	-1.06	2.34	+.64	2.17	+.47
May	2.75	+.29	6.28	+3.82	2.67	+.21	.46	-2.00	3.01	+.55	2.06	-.40	.94	+1.52	3.26	+.80
June.....	.82	-3.22	.54	-3.50	.89	-3.15	2.67	-1.37	3.01	-1.03	2.22	-1.82	2.05	-1.99	3.53	-.51
July .....	.81	-2.30	.95	-2.16	2.10	-1.01	5.67	+2.56	3.12	+.01	3.96	+.85	1.99	-1.12	3.57	+.46
August....	4.00	+.14	.76	-3.10	3.94	+.08	2.50	-1.36	2.18	-1.68	6.25	+2.39	4.56	+.70	3.00	+.86
Sept.	6.19	+2.52	5.76	+2.09	2.14	-1.53	8.25	+4.58	4.79	+1.12	3.99	+.32	6.55	+2.88	7.36	+3.69
October..	6.00	+.68	3.61	-1.71	7.56	+2.24	7.39	+2.07	7.75	+2.43	4.37	-.95	5.33	+.01	8.81	+3.49
Nov.	7.80	+2.82	4.19	-.79	4.23	-.75	1.77	-3.21	7.42	+2.44	5.82	+.84	4.73	-.25	7.20	+2.22
Dec.	9.40	+4.16	5.52	+.28	3.58	-1.66	4.49	-.75	9.19	+3.95	1.26	-3.98	6.72	+1.48	2.86	-2.38
Total ...	53.85	+7.74	43.44	-2.67	39.73	-6.38	49.12	+3.01	68.83	+22.72	47.66	+1.55	48.16	+2.05	56.11	+10.00

1876, January, 1.54; difference from average, -3.65.

he records of the float gauge, because it *alone* could properly be compared with the average 1860-5, the new gauge not having been started until afterwards. The printed forms used for the monthly returns do not require any particulars as to the gauge used, since it has been thought unnecessary to give the observers the trouble of filling in these details twelve times a year.

However, it is useless to discuss the past, but owing to this misunderstanding we have, for more than eight years, been comparing the actual fall by the 1ft. gauge with the average by the 2ft. 6in. gauge. Many people would think this a small matter, but it is not. During the past eight years the mean fall by the 2ft. 6in. gauge has been 50·46in., and by the 1ft. gauge 52·52in., an excess of 2·06in., or almost exactly 4 per cent.

The whole of the corrected values are given in the table on the previous page.

Now for the moral. Accurate comparisons for the determination of seasonal change can only be made under three conditions—

- (1.) Between records similarly kept, of one gauge, in one position.
- (2.) Between records similarly kept, of two gauges, both tested and found correct, and in the same position.
- (3.) Between records similarly kept, of two gauges, or two positions, provided that Rule II. has been observed and the records carefully differentiated. Condition No. (1) is, however, far the safest.

THE BAROMETRICAL DEPRESSION OF MARCH 12TH.

[We think it better to give the following facts verbatim than in any other form. The depression seems to have passed nearly over the metropolis; the wind, however, was not so violent as on the 14th.—Ed.]

Sea Level Pressure, Camden Square, March 12th, 1876.

Time.	Pressure.	Time.	Pressure.	Time.	Pressure.
9.0 a.m.	28·706	0.15 p.m.	28·457	3.30 p.m.	28·848
10.5	·615	.30	·447	.45	·902
.20	·592	.45	·459	4.0	28·940
.30	·577	1.0	·460	4.30	29·006
.45	·561	.15	·462	5.0	·047
11.0	·545	2.0	·551	6.0	·086
.15	·531	.30	·659	7.0	·146
.30	·509	.45	·703	9.0 p.m.	29·234
.45	·491	3.0	·763		
Noon	28·473	3.15 p.m.	28·813		

REMARKS.—The noticeable feature in this depression was the rapid rise between 2 and 3·45 p.m., viz., 0·351 in., or 0·200 in. per hour. A rise of half-an-inch occurred between 2 p.m. and 5.10 p.m., or in 3 hours and 10 minutes.

G. J. SYMONS.

To the Editor of the Meteorological Magazine.

SIR,—I hasten to inform you of the terrific snowstorm experienced here to-day; the early morning showed us a white mantle over the earth, and snow still falling in a calm, with, at 9 a.m., a temperature about freezing, and 0·46 in. rainfall or snowfall; at 10 a.m. wind shifted from S.E., to which it had backed from W. yesterday, to N.E., and sprang up to a terrific gale or hurricane, with an immense snowfall, which lasted till 3 p.m., and then calmed down into much less wind and a smiling sky, promising a cold night. Temperature rose from 32° to 34° and 36°, then fell to 32°, and rose again to 34° at 5 p.m.

I fear the results of such a storm in other districts.

Yours faithfully,

HENRY ST. JOHN JOYNER.

Northwick House, Harrow, Sunday, March 12th, 1876, 8 p.m.

SIR,—We were visited yesterday by a most tremendous snowstorm. Snow commenced early in the morning, and continued very heavily till about 8 a.m.; from 9 a.m. to 0.15 p.m. there was a thick fine rain at times. At 0.30 p.m. a second storm commenced; the wind shifted to N.E., and blew with terrific force, accompanied by a fall of snow, so dense that it was impossible to see more than 50 yards; this continued till 2.30 p.m., when the wind shifted to N.W. the snow ceased, and the gale rapidly subsided. The snow melted almost as rapidly as it fell, so that it was not more than 4 in. in depth. The rain gauge yielded 1·18 in., which would give a depth of 14 ins.

The barometer fell very rapidly till 1.43 p.m., when a rapid rise commenced. The following are the readings:—

8th, 9 a.m.	29·46 in.	12th, 9 a.m.	28·47 in.
9 p.m.	28·77 „	0.30 p.m.	28·35 „
9th, 9 a.m.	28·62 „	1.43 „	28·29 „
9 p.m.	28·47 „	2.30 „	28·40 „
10th, 9 a.m.	28·48 „	4.30 „	28·75 „
9 p.m.	28·57 „	9 p.m.	28·97 „
11th, 9 a.m.	28·80 „	13th, 9 a.m.	29·33 „
9 p.m.	29·00 „		

Yours truly,

THOS. PAULIN.

Enfield, 13th March, 1876.

SURBITON.—At 11 a.m. the wind on ground was due E.; a good weathercock, 160 ft. above ground, showed the wind was S. by E., the clouds, not very high, were coming from W. by S., the wind strong, both below and above. My barometer, not a standard—no correction applied—was at 1 p.m., when the wind changed to N., 28·34, at 5 p.m. it was 28·94, a rise of six-tenths! in four hours—all carefully noticed.

G. D.

SIR,—Barometer at 1.30 p.m. to-day, corrected for temperature, but not reduced to sea level, 28·356 [28·524 at Sea Level], had risen at 10 p.m. to 29·15. Melted snow and rain fallen to-day, between 7 a.m. and 10 p.m. 0·627 in. A fine calm night, barometer rising, and external thermometer in air 34°.

Yours sincerely,

WM. FRED. HARRISON.

Bartropps, Weybridge, March 12th, 1876.

P.S.—Just this weather in 1870, day for day.

SIR,—As the barometer has been so extraordinarily low for the last few days, I send some barometrical readings, corrected and reduced to Sea Level—

8th, 9 a.m.	29·724	12 noon	28·736
9th, „	28·876	0.30 p.m.	724
10.55 a.m.	843	1 „	710
12 noon	823	1.30 „	706
1.30 p.m.	810	3 „	708
4.30 „	779	4 „	715
5.30 „	775	5 „	741
6.30 „	743	6 „	28·763
11.30 „	675 min.	11th, 9 a.m.	29·070
10th, 8.15 a.m.	798	9 p.m.	29·253 max.
9 „	700	12th, 9 a.m.	28·686
10.30 „	687	1.30 p.m.	28·437 min.
11 „	720	3.15 „	28·762
11.30 „	28·722	13th, 9 a.m.	29·619

Two large trees blown down in the Rectory Grounds yesterday, and one in Kelsey Park.—Yours truly,

C. O. F. CATOR.

The Hall, Beckenham, 13/3/76.

SWARRATON RECTORY, ALRESFORD.—March 12th, 10.20 a.m. ; Kew Standard Barometer, corrected and reduced to sea level, 28·56 ; lowest observed.

W. E.

SIR,—We have just had a severe snowstorm. It began about 5 a.m. yesterday, March 12th, and continued till 3 p.m. ; there was also another fall last night. During the storm there was a violent N.E. wind, which drifted the snow in places to 1½ ft. deep or more.

Fall by gauge, 9 a.m., 12th	...	...	0·25 in.
„ „ „ 13th	...	...	0·72 in.

As it was thawing all the time, it was impossible to tell the true depth of the snow.

The barometer (aneroid) has been very low for the last 5 days, the lowest readings being at 9 p.m. (9th) 28·215, and at noon yesterday (12th) 28·250, uncorrected.—Yours truly,

EDWARD C. MORRELL.

Broughton Lodge, Banbury, March 13th.

SIR,—We have had such extraordinary weather and barometrical changes here that they deserve to be put on record.

On Thursday morning, the 9th, the barometer had fallen eight-tenths of an inch, and at 11 in the forenoon of Friday, so dense a cloud, of apparently London yellow fog, came on, that we were obliged to light the gas for about a quarter of an hour. On the 10th, 11th, and 12th the mercury continued to fall, till on Sunday evening it reached 28·2. It has now (9 o'clock on Monday) risen an inch.

0·62 of an inch of snow has fallen, with a cutting N.E. wind all yesterday, which has now veered to N.W. and W. Such weather has not been remembered “by the oldest inhabitant” at this season of year.

The thermometer showed 3 degrees of frost, four feet from the surface, last night, but the temperature is rising rapidly. 1·64 of rain and snow has already fallen this month, during which there has been only one rainless day.

This state of things is materially affecting agricultural pursuits, as but little barley has been sown, and the earth is so saturated with wet that some time must elapse before the land can be prepared.

Last month 2·35 in. rain fell in 18 days, but in January only ·89 in 9 days.

We have had very strong gales for the last week, from all quarters of the compass.—Yours truly,

H. EDEN COCKAYNE.

Dunmow, March 13th, 1876.

UNDERGROUND THERMOMETERS.

SIR,—In December last I resolved to commence the new year with a record of the earth temperature, and having considered the three important points to be settled—viz., (1) the depth at which it seemed most desirable that it should be taken; (2) the most convenient method of taking it; and (3) the best means of securing isolation from the air temperature, I devised the following plan; but the arrival of your January number of the *Meteorological Magazine*, containing an article upon the subject induced me to wait and think over the matter a little longer before finally adopting it. After some consideration, I could see no reason for altering it, and I send it for your opinion, in case you may recommend any modification. I have a square open wooden tube of $\frac{3}{4}$ in. deal, about 2ft. long, at the bottom of which is a continuation in zinc 1 foot long; the size of the tube is just sufficient to receive a glass quart bottle (filled with water and corked); the cap which covers the top of the tube is attached to a piece of deal quartering, filling the tube easily but pretty closely, and descending to within an inch of the gork of the bottle; a piece of copper wire fastened to the neck of the

bottle and brought up under the cap serves to draw up the bottle when the temperature is to be taken, which I do by means of an unmounted thermometer with a long stem. When the whole is in position, the square wooden cap of inch deal is four inches below the surface of the ground, and is covered with soil to that depth, and I place a square 7in. stone tile over all to mark the spot. The bottom of the bottle is just 3ft. below the surface. The position chosen is an open part of the kitchen garden. It appeared to me that the great capacity of water for heat is a circumstance to be taken advantage of as being likely to give a more trustworthy reading than a sensitive thermometer drawn up from below, not easily read in an instant, and almost sure to take up the air temperature more or less as it is drawn up. The plan seems too simple to stand in need of an explanatory diagram.

I am, Sir, yours faithfully,

HENRY COOPER KEY.

Stretton Rectory, March 3rd, 1876.

[We have much pleasure in placing Mr. Key's letter before our readers, and as he asks our opinion, we add a few remarks, although we trust that no weight will be attached to them except that which they may intrinsically possess. The subject is one well worthy of consideration, and we trust that neither Mr. Key's remarks nor our own will be looked upon as settling the best method of observation. The first step is, perhaps, to discuss the subject; the next to try those methods which appear most promising; then two or more of the selected methods should be tried by the same observer, and after the best plan has been decided upon, we must try to secure precisely similar methods being adopted in all parts of the world.

Before making any remarks upon Mr. Key's letter, we may quote the original note as to the water-bottle method from the *Report of the Committee [of the Royal Society] on Physics, including Meteorology*, 8vo., London, 1840, p. 60 :—

"The temperature of the soil at different depths is a point of considerable importance. For this purpose excavations should be made in a dry, sheltered situation 3, 6, and 9 feet deep, and lined with brick or earthenware tubes. In the bottom of these excavations earthenware quart bottles may be carefully placed, filled with water, spirit or brine, and corked. They must be carefully covered with tow or cotton, and drawn up on the days of horary observation, and their temperature taken by an accurate thermometer."

From Mr. Key's letter it almost appears that he is not aware of the above paragraph; if so, it is another proof of the difficulty of proposing anything absolutely new; this, however, is an unimportant point.

It appears to us that the principal objections to Mr. Key's method are (1), The covering of soil and stone is doubtless very effectual, but it can hardly be pleasant to have to disinter the bottle for each observation. (2). It does not appear certain that rain water may not penetrate to the level of the bottle faster by the side of the tube than in other parts of the garden; this is one of the greatest difficulties with underground thermometers. (3). The addition of a wrap of dry flannel round

the bottle is most desirable. (4). The thermometer employed must be a very sensitive one, or it must be left in the bottle a considerable time.* (5). If "the *bottom* of the bottle is just 3 ft. below the surface," we should regard the temperature of the bottle of water as that due to its middle, say 2 ft. 6 in.

With respect to Mr. Key's remarks upon the method described in our January number, we ought to point out that we have purposely used a sluggish spirit thermometer, very easily read, and buried in non-conducting material for the express purpose of guarding against change during raising and reading.

At present we regard the modifications of the German method proposed in our January number, and (for great depths) Mr. Wallis's improvement of it, as both accurate and luxurious; but we are very glad of such criticism as Mr. Key's, and hope that it will lead to the uniform adoption of some *one* method—for uniformity is even more important than accuracy.]

REVIEW.

Storms: their Nature, Classification and Laws, with the means of predicting them by their embodiments, the Clouds. By WILLIAM BLASIUS, formerly Professor of the Natural Sciences in the Lyceum of Hanover. Philadelphia: Porter, and Coates. London: Lockwood & Co.

PROFESSOR BLASIUS has made a big book; and as to whether it is good, bad or indifferent there will not be much difference of opinion. Some books, wrote the great Lord Bacon, are to be read wholly, others in part only, and some few are to be chewed and digested. Sydney Smith asserted that the art of reading consisted in judicious skipping. The reviewer would have liked to skip much of this book, but he actually did endeavour conscientiously to digest it. The result having been mental dyspepsia, he would advise none but the strongest minded meteorologists to make the like attempt. He can safely inform the rest of his readers that they will not find the Professor's style very perspicuous, his logic very convincing, his facts very numerous or very consistently used, his nomenclature very appropriate, or his theory very clearly propounded. With many of the sentences the greater the endeavour fully to comprehend them, the greater the mysticism which they appear to evolve. However, an attempt has been made to arrive at the simplest possible conception of the author's theory, and this is its summation:—

1. A storm is the result of a warm wind blowing *into* a cold one; or all storms come against the prevailing wind, and, as he says at p. 199, "a mutual displacement takes place, which is the basis of our whole system."

2. In winter storms, a warm current flowing to north-east doubles up, or pushes back, a cold wind blowing to S.W.

3. In summer storms, a cold current from N.E. or N.W. pushes the warm S.W. current before it.

4. At the "plane of meeting" of the two winds there is calm, with a *low* barometer.

5. In winter the warm wind tops far over the cold one, so that the plane of meeting is oblique. In summer the plane of meeting is steeper, because the cold wind banks up against the warm one, but cannot top it. "The tendency of the plane of meeting to incline, corresponds with the declination of the sun's rays." (p. 200).

6. The district of rain is under the slope of the plane of meeting.

7. The signs of storms, the Professor assures us, are to be found *in nubibus*. There are no storms without clouds. The cirrus is the precursor of winter storms; the cumulus of summer storms.

8. Storms, we learn for the first time, pass over us and then come back again.

9. The origin of tornadoes is to be sought in the configuration of the ground, or the warm currents of the ocean. A tornado moves in a diagonal of two conflicting winds, oscillates to right and left, and whirls at intervals! It *gains* strength the *rougher* the ground, and disappears over plains. At sea it favours the Gulf Stream and the Black Stream. "The tornado follows entirely different laws in its motion and appearance from those of storms generally, and therefore cannot be made the base of universal storm theories." "There are different kinds of storms—different in their origin, motions, effects, and appearances."

Of course the Professor thinks that meteorology is at present in a state of transition. Most writers on Meteorology make this gratuitous assertion. Few, however, will agree with him that meteorologists have hitherto mistaken *effect* for *cause*, or that "the science has been almost at a standstill for the last quarter of a century." During all this time, fortunately, the Professor has been incubating his theory, which is to complete the transition, make Meteorology a perfect science, and the world wiser for ever!

It was in 1851 that the Professor examined the ravages made by a tornado at West Cambridge, U.S. He failed to explain the positions of the prostrated objects, either by the rotatory theory as developed by Redfield, or by the inblowing theory as propounded by Espy. Brooding over the matter, now and again, during this great length of time, he has at last imagined, satisfactorily to his own ideas, a reformed theory of storms, which, while combining something from all other theories of winds and storms, has certainly superadded much that is novel and ingenious, although perhaps it may be fanciful and speculative. Without resorting to the millions of meteorological observations tabulated before and greatly increased since his tornado investigation, without indeed using any facts to support his doctrine, he finds in his

own mental resources all the materials for his aerial scheme. And this scheme he offers to the world in a good sized book, with geometrical diagrams of storms and gloomy illustrations of clouds.

The theory unhesitatingly assumes that two large portions of the atmosphere, on the same level but of different temperatures, can and actually do blow directly against each other. This, however, is contrary to the laws which regulate the direction of winds. It never happens in nature, therefore the theory cannot group together, under any relation of cause and effect, aerial phenomena. The notions of the plane of meeting, of its inclining from the perpendicular into positions more and more oblique, and of its returning to the perpendicular, with the progress and retrogression of storms, are all fantastical and without analogy in nature.

According to the theory there cannot be a polar air current above an equatorial surface current, which alone is quite enough to show its incompetency. Have not aeronauts found again and again strong polar currents over strong equatorial surface winds? Then what becomes of the theory? There is scarcely anything really sound to be found in it, but it is not worth space and time to refute absurd geometrical speculations, and jargon about plane of meeting, line of lowest barometer, oscillation of storms, &c.

The phenomena of latent heat, clouds, and precipitation are explained by old established physical principles, and, of course, are easily lugged into any theory. Thus, with a little cleverness, the theory gets the credit of explaining phenomena for which in truth it cannot possibly account. A perusal of the work and a study of the U.S. synchronous weather charts for one month would be convincing that the theory is incompatible with the operations of nature in winds and storms. In fact, the work does not describe the nature of storms; nor does it classify them; it neither expounds their laws nor does it teach the means of predicting them. The Professor has failed to grasp the significance of areas of high, as well as of low pressure, their relation, the circuits of isobars, and the relation of winds to them. Asserting "I am satisfied that it is the true explanation," and asseverating to the like effect, do not hasten conviction in the thinking reader. They only serve to indicate the doubts lurking in the mind of the writer himself, who, having laboriously spun out page after page of futile reasoning, sees that this is no thorny logic, but mere windy talk, and dismisses it with an afflatus derived from his own despairing desire to make that which is not convincing convey the simulation of conviction.

The Professor attributes to the phenomena of clouds a precision of approach, formation, passage, and recession over the visible firmament, such as the reviewer has never perceived the faintest indication of, during a long series of years as an observer. Others may have been more fortunate, but the scheme seems very idealistic. To describe a series of stripes of clouds marching over the horizon from the S.W., extending when over the zenith from N.W. to S.E., and disappearing

in the N.E., while a N.E. gale of wind is blowing below, until the plane of meeting arrives from the S.W., bringing calm and low barometer; then being succeeded by a S.W. gale, with winds veering from N.E. to E. and S.W. on the S.E. extremity of the *straight line* where the plane of meeting strikes the earth, and from N.E. to W. and S.W. on the N.W. extremity, with concomitant phases of weather; and then a backward repetition of all this, or an oscillation of the storm; is all matter of mere moonshine, the reasoning of an idealist, of a dreamer. All these kinds of sequences are described through many pages for the so-called N.E. storm. Then a second set of aerial quadrilles are arranged for S.E. or S.W. storms, equally fantastical. Put in the configuration of the land, and on favourable occasions you have the tornado waltz, when—stand clear!

Such works as this may tend to make mariners distrustful of the laws of storms, which have proved so useful to the security of navigation. They are, therefore, to be regretted, for the laws of storms have been developed by infinitely more pains and labour than any refuter of them has yet brought to his task. To set at nought the laws of storms, which half a century's experience has only tended to confirm and render more acceptable, is no light task to be undertaken by any individual; and he who does so should come armed with irresistible facts and proofs. Otherwise his labours are worse than useless, they are mischievous; but of this we may feel sure that neither Blasius's account of the nature, his classification nor his laws of storms will meet with general acceptance. The manner in which he presses into his support such meteorologists as Mohn, Hildebrandsson, Loomis, and others, is scarcely intelligible. He describes phenomena which take place beyond mortal ken with a rashness which is surprising. For instance, he gives a wonderful account of the formation of hailstones, pp. 140-1, which, like the work generally may be accepted with his own advice "obscure and complicated explanations are always to be regarded with suspicion."

At p. 44, "*par le vent d'est*" he translates "with a *west* wind. At p. 57, the lengths of quadrants of the parallels are given as the lengths of their *circles*. At p. 111, we are told that Otto von Guericke invented the barometer. At p. 211, we learn that Dover, England, is 2,000ft. above the sea, and the author's argument is based on this idea, although the facts apply to Dovre, in Norway. He conceives the barometrical gradient to be identical with "the plane of meeting," showing that he does not understand what is meant by the gradient, see p. 252. The trade winds, he says, at p. 259, "preserve a constant serenity and, a cloudless sky." Such are some of the qualifications for a propounder of a new theory of storms, working without facts, using second-hand information, and drawing largely upon the imagination. He says, "I am convinced that the existing theories of the nature and laws of changes of weather are intrinsically erroneous," and the writer of this review is equally convinced that a *less* "nearer approximation to the truth will be found in this volume."

E. I. L. A. C. E.

AURORA, FEBRUARY 21st.

To the Editor of the Meteorological Magazine.

SIR,—On Saturday evening, the 19th inst., an aurora was observed here, the record of which may not be without interest, for comparison with the notes made by other observers, which may probably appear in the *Meteorological Magazine*.

During the whole of the day a strong cold north wind blew until near 6 o'clock in the evening, when it suddenly became calm. At 7 o'clock I observed an auroral light in the northern part of the sky, but was told that it had existed half-an-hour previous. The following is a copy of notes taken occasionally during the evening. The barometer registered 29·25, and the thermometer 39° Fahr.

7.0. Bright light from W.N.W. to N.N.E.

7.15. A few gray streamers N.N.E. ; thick black clouds rising in the west.

7.20. Light diffused : no streamers.

7.25. Bright gray streamers N.N.W. ; a shower of rain with wind.

7.30. No streamers ; rain continues to fall.

7.33. Bright band from N.W. to N.N.E.

7.40. Streamers N.N.W., N., and N.N.E.

7.50. No streamers ; light diffused.

7.55. Light diffused and much less intense.

7.56. Bright meteor, shooting downwards at N.N.W., from an elevation of about 30°.

8.0. Light still diffused, but extending farther east.

The light continued to be diffused without any streamers being visible up to near 11 o'clock, when my observations of the aurora ceased.

W. H. WATSON, F.C.S., F.M.S.

Braystones, near Whitehaven, Feb. 21st, 1876.

P.S.—I have since found that a friend residing only about a mile from here, observed the aurora between 12 and 3.30 on the morning of the 20th, and describes it as splendid—crimson and gray streamers being almost constantly visible.

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- Llandudno as a Watering Place. (From the Report of the Sanitary Record). 16mo. Llandudno, 1875.
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SUPPLEMENTARY TABLE OF RAINFALL IN FEB., 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	2.03	Llanfrechfa	7.85
Hailsham	2.83	Castle Malgwyn	3.71
Andover	3.06	Heyope .....	...
Strathfield Turgiss	2.03	Rhug, Corwen	4.65
Addington Manor	2.54	Port Madoc	5.57
Oxford	2.81	Melrose	4.60
Cambridge	2.21	Cessnock, Glasgow	5.14
Sheering	2.37	Gruinart	3.78
Ipswich	2.38	Keith	4.69
Diss	2.94	Strathconan	5.57
Swaffham	3.48	Springfield, Tain	3.77
Compton Bassett	3.53	Skibbereen	5.21
Dartmoor	9.64	Glenville, Fermoy	5.41
Teignmouth	3.58	Tralee	4.99
Torrington	5.73	Newcastle, W. Limerick	4.39
Trevarrick, St. Austell	5.08	Kilrush .....	...
Taunton	3.56	Kilkenny	4.63
Bristol .....	...	Kilsallaghan	3.95
Sansaw	2.20	Twyford, Athlone	4.45
Cheadle	3.46	Ballinasloe .....	...
Ashby-de-la-Zouch	2.86	Kylemore	9.85
Coston, Melton Mowbray	2.22	Bangor	6.37
Bucknall	1.99	Carrick on Shannon	5.52
Walton, Liverpool	3.03	Rockcorry	4.48
Broughton-in-Furness	6.18	Warrenpoint	5.18
Stanley, Wakefield	2.27	Bushmills	3.47
Gainford	1.89	Buncrana	4.01
Shap	7.05		

FEBRUARY, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which -01 or more fell.	Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
											inches.	in.	
I.	Camden Town	1·97	+·75	·36	20	18	58·6	29	23·0	12||	8	14	
II.	Maidstone (Linton Park).....	2·94	+1·43	·47	15	20	60·0	18	18·0	11	10	...	
III.	Selborne (The Wakes).....	3·87	+2·16	·65	14	20	55·0	28*	19·0	12	7	10	
IV.	Hitchen	2·38	+1·12	·34	14	23	55·0	29	22·0	9, 11	14	...	
V.	Banbury	2·28	+·85	·27	14	22	56·0	29	18·5	12	11	...	
VI.	Bury St. Edmunds (Culford).....	2·59	+1·17	·51	5	18	58·0	29	20·0	11	13	16	
VII.	Sproston	2·80	...	·37	14	22	...	...	...	...	...	...
VIII.	Bridport	3·49	+1·43	·53	16	20	56·0	27	22·0	12	16	...	
IX.	Barnstaple.....	3·90	+1·82	·65	16	19	57·0	23	29·0	12	...	...
X.	Bodmin	4·91	+2·12	·83	16	23	56·0	26	30·0	10	3	4	
XI.	Cirencester	4·14	+2·53	·52	16	17	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	3·20	+2·31	·48	13	17	54·0	18†	12·0	12	15	17	
XIII.	Tenbury (Orleton)	2·90	+1·33	·36	18	22	58·3	28	18·3	12	7	15	
XIV.	Leicester (Belmont Villas)	2·78	...	·38	14	22	59·0	29	20·5	12	8	...	
XV.	Boston	2·13	+·92	·39	14	19	58·0	18*	24·0	11	10	...	
XVI.	Grimsby (Killingholme)	2·40	...	·36	14	24	56·0	29	24·0	10	7	...	
XVII.	Mansfield	3·03	...	·46	14	21	56·8	29	18·1	10	14	14	
XVIII.	Manchester	3·98	+2·03	...	...	...	...	...	...	...	...	...
XIX.	York	2·15	+·77	·34	13	21	55·0	2	23·5	9	12	...	
XX.	Skipton (Arncliffe)	8·47	+4·80	1·52	21	22	...	...	...	...	...	...
XXI.	North Shields	2·42	+·89	·40	28	24	52·4	29	25·0	13	11	20	
XXII.	Borrowdale (Seathwaite).....	16·21	+4·83	2·96	20	...	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	6·20	+4·13	·93	14	23	...	...	...	...	...	...
XXIV.	Haverfordwest	5·04	+2·18	·88	14	14?	52·0	var.	27·0	11	10	14	
XXV.	Machynlleth	9·23	...	1·83	17	19	51·0	29	19·0	11	9	...	
XXVI.	Llandudno	3·01	+1·66	·56	17	21	57·0	28	25·0	11	4	...	
XXVII.	Dumfries (Crichton Asylum).....	5·09	+2·76	·77	21	16	51·0	23	22·2	11	17	19	
XXVIII.	Hawick (Silverbut Hall)	4·74	...	·67	2	19	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill).....	3·96	...	·70	27	18	50·7	23	21·7	11	16	18	
XXX.	Castle Toward	5·49	+1·75	1·11	19	15	48·0	1	20·0	11	18	...	
XXXI.	Quinish .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	3·46	...	·65	14	14	...	...	...	...	...	...
XXXIV.	Braemar	2·49	+·51	·50	18	19	49·0	1	16·3	20	20	26	
XXXV.	Aberdeen	4·41	...	·74	26	26	51·5	22	25·1	10	11	24	
XXXVI.	Loch Broom	4·58	+·84	·63	4	17	...	...	...	...	...	...
XXXVII.	Portree	6·07	+4·16	·89	1	17	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	2·08	+·20	·63	28	21	52·8	1	21·2	14	14	25	
XXXIX.	Helmsdale	4·49	...	·70	28	26	...	...	...	...	...	...
XL.	Sandwick	3·58	+1·10	·58	18	22	49·9	1	23·2	21	12	19	
XLI.	Caherciveen Darrynane Abbey .....	...	...	...	...	...	...	...	...	...	...	...
XLII.	Cork	4·36	...	·50	13¶	24	...	...	...	...	...	...
XLIII.	Waterford	6·20	+4·17	·78	12	24	58·0	17†	28·0	6	5	...	
XLIV.	Killaloe	5·28	+2·38	·63	14	24	57·0	28	27·0	6	...	...
XLV.	Portlanning	3·67	+1·64	·75	10	25	54·0	17	27·0	5	12	...	
XLVI.	Monkstown, Dublin	3·46	+1·82	1·02	12	19	...	...	...	...	...	...
XLVII.	Galway	5·31	...	·53	17	25	55·0	27	24·0	6	5	...	
XLVIII.	Ballyshannon	4·60	...	·60	3	20	...	...	...	...	...	...
XLIX.	Waringstown	3·83	...	·63	17	24	56·0	28*	18·0	11	15	17	
L.	Edenfel (Omagh)	4·08	...	·49	3	22	50·0	21§	20·0	11	16	...	

* And 29.

† 28 & 29.

‡ 18.

§ 28.

|| 13.

¶ 17.

† Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY.

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.—Wintry from 6th to 14th, the ground being mostly covered with S during that time, the rest of the month very mild, but wet and dirty; winds (never high) mostly S., S.W. and W. Bar. generally unsteady. With the exception of 1866 and 1869, it has been the wettest February for upwards of 20 years, while on the other hand, it has been an unusually mild one.

SELBORNE.—Prevailing winds after the 13th, S.W. An extremely wet month R much above the 12 years' average for February; S and sleet in the early part of the month; fog daily from 9th to 21st inclusive. Much wind on the 23rd.

BANBURY.—High wind on 3rd, 15th, 21st, 26th and 28th.

CULFORD.—February has this year been much milder than is usual in this part of the country, the mean temp. having been 40°·3, and easterly winds less prevalent, having been from that quarter only on five days; vegetation is, consequently very forward, apricot trees being already in full bloom. S fell on 4th to 7th inclusive, and again on the 13th.

SPROUSTON.—A very wet month. It has been "February fill-dyke" this year, having been about 1½ in. above the average. Like December and January it was cold at the beginning, and mild in the latter half.

BODMIN.—S on 10th and 11th.

CIRENCESTER.—S on 13th.

HAUGHTON HALL, SHIFNAL.—The first half of the month exceedingly cold, frost every night (but the 1st) till the 16th; on the night of the 13th about 6 in. of S fell, which was washed away the next night by heavy R; from this date to the close (with the exception of the 19th, 21st, 22nd, and 27th) the R fell daily; the fall 3·20 in. more than 2·25 in. above the average, and the wettest February during 41 years, the next greatest fall was in 1837, when 3·15 in. was registered. Sleet daily from 3rd to 10th, followed on the 11th by dense fog all day. The prevailing winds were W. and S.W., amounting to storms on the 15th, 16th, and 21st.

ORLETON.—The first half of the month was cold and generally cloudy, with frequent frosts and a mean temp. very much below the average. On the 11th there was a severe frost and very dense fog in the valleys all day, leaving a beautiful rime on all the trees, &c.; another severe frost on 12th, followed by S on the 13th. On the 14th a rapid thaw set in, and the remainder of the month was very warm, though stormy. Between 1.30 and 2.30 a.m. on 16th, a heavy TS with H and R passed over from W. to E., which was scarcely felt to the S. of this place, but was much heavier to the N. Faint distant T again heard on the 18th. Wind very rough on 23rd and 29th. The mean temp. of the whole month rather more than 1° above the average.

LEICESTER.—On the whole a mild month, temp. on 10 days exceeded 50°. Only three nights of sharp frost. Mean temp. of month 40°·5. Heavy S on night of 13th, 3 in. deep, which had all melted by the night of 14th.

BOSTON.—S on 14th and 25th, T and L on 16th.

GRIMSBY.—A very wet month, having a rainfall (2·40) exceeding that of the two preceding Februaries put together, and slightly exceeding February, 1872. Bar. seldom above 30 in. Snowdrops and crocuses beginning to flower on 2nd; pilewort and pyrus japonica began flowering on 18th, and hazel catkins shedding pollen on 19th; rooks building on 26th; old moon in the arms of new on 27th; lunar corona at 5.30 on 3rd.

MANSFIELD.—February, as a whole, has been a pleasant month, the weather, though severe at the beginning, was fine and bright, and in the latter part was very bright and sunny, with showers, though often wet nights. TS, with heavy H on 16th.

NORTH SHIELDS.—S almost daily to the 14th, and on the 20th and 25th, aurora on 19th.

WALES.

HAVERFORDWEST.—The wettest February for many years past ; from the 4th to the 13th very cold. S fell for the first time this winter on the 10th, melting as it fell, except on the mountainous parts of the country and the higher lands. The remainder of the month stormy, mild and wet. A very variable month, prevailing winds during first fortnight E. and S.E., the rest of the month W. and S.W.

MACHYNLLETH.—A changeable month, with heavy fogs and rough winds, and very wet from 13th to the end of the month ; the ground covered with S on 9th ; T on the night of 15th.

LLANDUDNO.—A month of changeable weather, both as regards temp. and R. A heavy fall of S on 13th and 14th, but all had disappeared by the morning of the 15th ; frost every night from 11th to 14th inclusive. Temp. slightly above the average, and the rainfall very greatly above it. Two peals of T with L and H, at 5 p.m. on 3rd. S on the distant hills to the 25th.

SCOTLAND.

DUMFRIES.—Rainfall more than double the average ; month generally wet and stormy, except in the early part, when there was upwards of a week of fine frosty weather. S fell heavily twice, but melted rapidly. Fine aurora on 19th. Mean temp. 39°·7.

HAWICK.—A very wet month, keeping back gardening and farming operations. S 6 in. deep on 25th.

ANNANHILL.—Frequent frost in the middle of the month. On the afternoon of 3rd mirage of Arran, Holy Isle, and Pladda being distinctly raised up. Sea seen below. T and L on 22nd. The heaviest fall of S this year fell on the 26th. Gales on the 2nd, 3rd, 19th, and 22nd.

CASTLE TOWARD.—The weather has been very changeable ; one or two days fine ; then R and wind, but not wind strong enough (as it has been in this month in former years) to blow down the trees. There has been little progress in vegetation this month, nor has it been suitable for out of door labour. The frost lasted longer than any we have had this winter, and was so severe that we filled our ice-house and got ice 3 in. thick.

ABERDEEN.—A very disagreeable month ; wet, with frequent showers of S, lying here 2 in. deep, inland on the moors it was very much deeper. Mean temp. 37°·3, or 0°·6 below average (19 years). Rainfall considerably above it, and exceeded only once (1872) in the last 19 years.

LOCHBROOM.—A very severe month. Frost, S, sleet, and storms rapidly following each other. R heavy for such a cold frosty month. Agricultural progress much retarded by the severity of the weather.

PORTREE.—A cold month. T and L with heavy H on 1st and 2nd at noon. T and L, at 8 p.m., on 15th ; very severe black frost from 3rd till the 10th. S on 12th, 23rd, and 24th ; squally from 25th to the end, and cold, with H and sleet showers. Cattle and sheep healthy.

CULLODEN.—Frequent S and H ; intense frost on night of 14th. Thrushes first seen on 11th and singing on 29th ; chaffinches on 26th, and larks on 28th.

SANDWICK.—A cold month. T and L, at 5 a.m., on 3rd. Bright aurora coruscating to zenith on 19th. There were two falls of S which remained for four or five days respectively.

IRELAND.

WATERFORD.—Several flashes of L on 15th.

GALWAY.—T and L on 22nd, 28th, and 29th. Aurora, between 9 and 11 p.m., on 19th.

BALLYSHANNON.—The month has been wet and stormy throughout, the rainfall exceeds that of February 1875 by 3·19 in. River Erne much swollen by constant heavy rain ; the ground is so wet that little or no seed has yet been sown.

WARRINGTOWN.—Hard frost in the early part of the month, and much rain in the latter part.

OMAGH.—Weather pretty fine to the 11th ; remainder of the month rainy and unsettled, but generally mild.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXIII.]

APRIL, 1876.

[PRICE FOURPENCE,
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OCEAN RAINFALL.

[THE determination of the fall of rain at sea is a very difficult matter. There is scarcely one of the conditions which are requisite for accurate observations on land which can be fulfilled at sea. The mouth of the gauge must be truly level, but how often is this possible at sea? Mr. Black, to whom we are indebted for the following communication, has endeavoured to lessen the evil by putting the gauge on gymbals (a method we adopted for the Nore Light Ship gauge, in 1866). At the best this is but a palliative. It is extremely difficult to find any but a very elevated position which is free from spray, and the influence of the sails, &c. A ship's rain gauge is always moving, and may travel *pari passu* with a cloud, and thus continue to catch rain from the same portion, or by the mere accident of their going in opposite directions, it may scarcely catch any. Mr. Gaster (*Brit. Rain.*, 1865, p. 13) in his article on "Ocean Rainfall," attacked the subject on the basis of *duration* of rainfall. Mr. Black has for some years been trying to obtain quantitative results, and we have much pleasure in drawing attention to the importance of the subject.—Ed.]

The following Return is an abstract of observations of the rainfall at sea, taken by direction of Capt. H. C. St. John, commanding H.M.S. *Sylvia*, on the passage from England to China, in March, April, and May, 1874, by the Mediterranean and Red Sea route.

It will be seen that there was but little rain in the Mediterranean, none in the Red Sea, and but little in the Arabian or Bay of Bengal, owing, probably, to the prevalence of the easterly winds and monsoons in spring. There next appears to have been more rain in the Java Seas about the change of the monsoons, and most in the China Seas, which will probably be coincident with the commencement of the S.W. monsoons at the approach of summer, except near Hong Kong, where the easterly winds would still have been blowing at that time. It will further be observed, that the amount of the rainfall was very small altogether, either in or out of the tropics, and the same phenomenon had already been observed by the late Capt. Goodenough, of H.M.S. *Pearl*, during a voyage in the Atlantic, in 1873 (*Nature*, vol. IX., p. 63). The general impression of landmen is, that there is

more rain falling at sea than on land, and it would be somewhat surprising if observers on board ship were to discover that this idea might be modified, and still more pleasant to find that on going a voyage one might be cheered with a prospect of dry weather.

These observations were taken with a marine rain gauge, of 6 in. diameter, of new design, a description of which appeared in *Nature*, two or three year's ago, vol. VII., p. 202, and of the working capability of which Capt. St. John speaks in satisfactory terms in the annexed extract from his letter.

Extract from Register of Marine Rain Gauge, H.M.S. SYLVIA, (Surveying Vessel) Capt. H. C. ST. JOHN, England to China.

1874. Date.	Lat.	Long.	Rain.	Locality.	Miles sailed.	Rate per diem.	Esti- mated winds.
Feb. 10	36 9 N.	5 19 W.	in. nil.	Gibraltar .....	...	...	W.
17	37 34 N.	9 29 E.	·010	Cape Spartivento, Mediterranean...	760	100	N.W.
18	36 50	12 47	·105	Sciacca, Sicily, do...	180	180	
19-22	35 54	14 31	nil.	Malta	110	110	
23-26	...	...	nil.	Mediterranean.....	...	...
27	31 57	30 7	·115	Alexandria, do.	(Alx)(Sd) 830+120	166+120	
28-Mar. 6	31 20	32 20	nil.	Port Said—Suez Ca- nal to Suez	90	17	
7-17	12 46	45 50	nil.	Red Sea to Aden.....	1385	126	S.E.
18-Apr. 8	6 3	80 13	nil.	Arabian Sea to Point de Galle	2333	106	N.E.
9	5 32	81 55	·020	Dendra Head, Bay of Bengal	130	130	N.E.
10	4 0	84 27	·116	Do.	185	185	
11-14	Equator	...	nil.	Do. ....	...	...
15	2 5 S.	95 47 E.	·020	Sumatra, do.	926	185	S.E.
16-20	...	...	nil.	Sunda Straits .....	...	...	S.W.
21	6 10	106 51	·025	Batavia Bay.....	720	120	
22-23	...	...	nil.	Do. ....	...	...
24	...	...	·025	Do. ....	...	...
25	...	...	nil.	Java Sea .....	...	...	S.E. & N.W.
26	3 50	108 16	1·230	Do., Biliton Straits..	180	90	
27	3 21	108 35	·090	Do.	35	35	
28	3 19	108 38	·180	Do.	4	4	
29-30	Equator	...	nil.	Do. ....	...	...
May 1	31 N.	108 16 E.	·020	China Sea ..	210	70	S.S.W.
2	2 35	109 58	·650	Do., Natuna Island..	180	180	
3	3 59	112 27	·500	Do.	175	175	
4	4 59	114 40	1·700	Do.	150	150	
5	5 15	115 7	·280	Labuan Island.....	30	30	
6	...	...	·550	Do. ....	...	...
7	7 47	116 47	·780	China Sea—Palawan Island, South Point	180	180	
8-13	2 12	114 15	nil.	Do., Hong Kong ..	900	150	S.S.E.

TOTALS : Days, 96 (stopped 10) ; miles, 9,735 ; rate mean, 113 per diem ; rain, 6·460 in.

[Extract from Letter.]

H.M.S. *Sylvia*, Hong Kong, June, 1874.

DEAR SIR,—I enclose the results of your rain gauge during our route from England to Hong Kong. My own impression is, it (the gauge) works well, where properly placed. I think a very good idea of what rain may be expected between any sea ports, when making a passage, could be come at, particularly by mail steamers. With the working of the gauge I am quite satisfied.

(For reference only).

H. C. ST. JOHN, Capt.

This return is intended only to serve as a sketch of what might be probably required to give prominence, and institute comparisons with, such data as may be collected on the subject of rain at sea.

These observations in the *Sylvia* denote amount of rain collected for the 24 hours previous to the registration, and the position will represent the point attained at the end of that time, probably 9 a.m. each day, and the intervals between these are the miles sailed per diem.

These two data must be considered as final anywhere, and at all times, and should be found in all ship's log-books. But other important items will be required to be appended to them—as the direction of the wind, for the noting of wet and dry winds, and the rate of the ship's sailing, or miles run per diem, for correction of rainfall collected.

There does not seem to be any definite relation in this abstract, to be detected between the rate of the sailing of the *Sylvia* and the quantity of rain collected on board, as in some instances the highest speed shows little rain; the greatest amounts were obtained at a medium speed, and the least at the highest rate of sailing, as may be imagined. The faster a ship sails or steams, the less rain will she collect in passing through a given area, of, say, a square degree; and the slower a ship proceeds, the nearer will it represent a stationary rain gauge, and the record in that area in a day, so that the rate of sailing becomes of importance to note for these observations.

These daily amounts of rain may be considered to be represented on a chart, as having fallen on a certain longitudinal space traversed, say, 100 miles, by 6 in. broad, and that the rain fell all the time in it of 24 hours.

This space again may be represented by concentrating the 100 miles, multiplied into 6 in. = 38,017,800 square inches, into a square figure of 175 yards, or the 1-hundredth of a square mile.

It may be imagined to be analogous, if the ship were stationary, and the atmosphere moved past it at the rate of the ship's sailing at this particular spot.

The following day the position of the rain gauge may be supposed to be moved to another specified spot of area corresponding to miles travelled, and which would be temporarily placed in the middle of the course sailed, and would remain another 24 hours there to collect the passing showers. In this view it may be proposed to consider the rainfall as having fallen at one spot for the 24 hours, and that this spot would be changed every day for fresh registration.

Any particular position in the ocean can, therefore, only probably receive one registration of its rainfall, but these may accumulate in the course of years in the area, of, say, a square of 5-10 degrees, so as to lead to some notion being obtained of the rainfall there.

An estimation of the probable rainfall in a certain space of a square degree for 24 hours previous, may be approximately obtained by ascertaining the time passed in sailing through it and dividing this into the amount of rain collected, and the quotient multiplied by the 24 hours required for the product.

If .021 inches of rain be collected for 24 hours, and the ship has sailed 240 miles, or 10 miles an hour, this will give 4 hours for passing through the square degree = to 1-6th of the whole time.

Then .021 divided by 4 and multiplied by 24 will give .126 in., the quantity that may be supposed to have fallen in that square degree, in the longitudinal space traversed if the ship had remained there an entire day.

It might conduce to simplify one's notions of rainfall at sea, and render such returns from ships more available, if we proposed to discard all references to localised showers, whether heavy or light, or of small or great extent, and adopt means and averages for realising our results, so that they may be uniformly placed on charts and tables of registration.

W. T. BLACK.

DIRECTION OF WIND.

To the Editor of the Meteorological Magazine.

SIR,—I fully agree with your correspondent, Mr. Robson, that the subject of "Direction of Winds" has not, so far as I have observed, obtained due attention. I have for some time past been engaged in researches on the subject, with a view of ascertaining whether anything like a definite rule can be laid down, for expecting a greater or less prevalence of Polar or equatorial winds during any coming month, season, or year. There is no doubt a general impression exists, that during a certain period we get something like a regular proportion, say, of N.E. winds. I have heard it said that the second three months of the year will make up in this respect for the first three, and to some extent this would appear to be so. However, the only test is an appeal to facts, and, with your permission, I will lay the following before your readers.

Since 1869 I have kept a monthly register of prevailing winds, deduced from the weekly Greenwich report.

A glance at this document will show that this is no easy matter, as four or five different directions are frequently given for one day. I can, therefore, only register what appears on the whole to have been the prevailing wind. Still, a register so obtained, if carefully compiled, would probably be more accurate than one obtained from any other

source, where the observations have probably been much fewer and less accurate.

My register so obtained for 1875 differs very materially from Mr. Robson's, which I think I may say is palpably incorrect in setting down 119 days to the S. & S.E.—two points of *least frequent* prevalence. The "Greenwich return" would indicate as follows :—

	1875.	Average for 6 years, 1870-75.		1875.	Average for 6 years, 1870-75.
S.	30	..... 28	N.	39	..... $30\frac{1}{2}$
S.W....	102	..... $108\frac{1}{2}$	N.E....	63	..... $53\frac{1}{2}$
W....	55	..... 65	E.	40	..... $30\frac{1}{2}$
N.W...	16	..... $24\frac{1}{2}$	S.E. ...	20	..... $24\frac{1}{2}$

I now give the number of days of Polar (N., NE., and E.) Winds for each successive half-year of the above period, with a view of showing whether or not there is any tendency to *equilibrium*, i.e., whether the succeeding six months, or the corresponding six months in the next year rectifies the excess or deficiency of any one season. it is, perhaps, needless to remark that an excess of Polar Winds implies a deficiency of those from the opposite quarters, and *vice versa* :—

	1st 6 months.		2nd 6 Months.		Total for year.
1870.....	63	.....	81	.....	144
1871.....	64	.....	60	.....	124
1872.....	38	.....	41	.....	79
1873.....	78	.....	31	.....	109
1874.....	60	.....	41	.....	101
1875.....	75	.....	68	.....	143
Average...	63		54		117

The average prevalence of Winds in each month, 1870-75 was as follows :—

	Polar.	Equatorial.		Polar.	Equatorial.
January	6	..... 20	August	10	..... 17
February ...	11	..... 14	September..	8	..... $19\frac{1}{2}$
March	13	..... 13	October ...	6	..... $2\frac{1}{2}$
April	12	..... $13\frac{1}{2}$	November..	11	..... $14\frac{1}{2}$
May	$13\frac{1}{2}$	..... $14\frac{1}{2}$	December...	10	..... 18
June	8	..... 17			
July	6	..... 20		$114\frac{1}{2}$	$201\frac{1}{2}$

The inference from the above would seem to be that we have a right to expect only a moderate prevalence of Polar Winds during the current year, 1875 having been considerably in excess. The prevalent winds are unquestionably the SW., W., and NE., and those of least frequent occurrence the NW. and SE. And perhaps the only clear and unmistakeable fact to be noted in connection with the subject is the prevalence of Polar Winds during the months of March, April, and May.—I am, Sir, your obedient servant,

F. TAYLOR.

19. Canonbury Park Square, N., March 25th, 1876.

THE THUNDERSTORM SEASON.

To the Editor of the Meteorological Magazine.

SIR,—Our thunderstorms are divisible into three classes, which merge, indeed, by gradations into each other, but which are in their typical forms, such as I am about to describe, essentially distinct.

Those of the first class predominate in the winter months. They are far the most numerous on the western shores of Europe. They occur with low, or very low, barometrical pressure, and most commonly with steep gradients and strong winds, and are almost confined to the southern segments of depressions. They rarely take place when there is any very great difference between the direction of the upper and under currents. They are equally common by night and by day. The altitude of the storm-clouds in this class is seldom so great as in the other two classes. Hail or snow frequently accompanies them. They are eminently local, and may, I think, be conveniently distinguished as *thunder squalls*.

Storms of the second type are very rare, except in the warmer months. They are least common upon our western coasts. They predominate with light winds, with moderately low pressure, and in the southern segments of depressions, but they are not at all particular as to the amount, or as to the distribution, of pressure. They are local in character, but may be very severe. They occur almost exclusively by day. Their formation may often be readily watched; cumulus, frequently under a sky devoid of upper cloud, swells to cumulonous; the summit of the latter assumes the cirri-form aspect, and a massive local nimbus is developed. I would denominate them *thunder-showers*.

The third class are *thunder-storms, par excellence*. They belong to the warm season. They are remarkably rare on our extreme western coasts. They are uncommon with pressures above 30·2, or below 29·4. They are most common when pressures are higher in the north than in the south of our islands, and when the isobars show local irregularities. But their most distinctive characteristic is the presence of an extensive and generally rapid southerly upper current (with more or less antagonistic surface-winds), carrying cumulo-stratus over a wide area, especially to the northward and eastward of the storms. Storms of this class are as common by night as by day. They are usually less local than the others. They travel at a great altitude, are often exceedingly intense, and afford the grandest electrical display, but are productive of remarkably few accidents in proportion to the number of discharges. Their first development can rarely be watched to advantage, but the process appears to be the reverse of that which occurs in the "thunder-showers," the aggregation commencing in the higher regions of the atmosphere, and being propagated downwards.

It may possibly interest some of your readers to compare the last 23 seasons with regard to the period of commencement, and relative frequency of the *last-mentioned type* of storms, in England.

1852. Commenced late: extremely abundant and severe, especially in July and August.
1853. Third week in May (heavy); a good deal below the average.
1854. Fourth week in July (?); scanty during the season generally.
1855. Fourth week in May (very slight); none of importance till June 6th; rather frequent and severe until August.
1856. Fourth week in April; very scarce throughout the season.
1857. Second week in April; frequent and very severe, especially in August.
1858. Third week in April; numerous and intense during the season.
1859. Last week in April (slight); numerous and heavy until August.
1860. Third week in May (?); very scarce throughout the season.
1861. First week in April; considerably below the average.
1862. Fourth week in March (slight); much below the average.
1863. Second week in April (slight); a good deal below the average.
1864. Second week in May (slight); extremely scarce throughout.
1865. Second week in May; moderate in extent, numbers, and intensity.
1866. Third week in March (slight); slightly below the average.
1867. Fourth week in April; above the average, and in many cases very severe.
1868. Fourth week in April; moderately numerous, but slight, considering the heat of the season.
1869. First week in June (slight); somewhat below the average.
1870. End of May (very slight); frequent in end of July; otherwise, scarce and slight.
1871. Commenced rather late; moderately numerous, and in several cases very intense.
1872. Fourth week in May (slight); exceptionally abundant and severe.
1873. Third week in April; rather frequent, but generally of moderate extent and severity.
1874. Fourth week in May; somewhat below the average, but rather numerous.
1875. Third week in May (?); of average numbers and severity.
1876. Slight storms of this type occurred in the northern and midland counties as early as the last week in March.

I am, Sir, yours very truly, W. CLEMENT LEY.

Ashby Parva, Lutterworth, April 4th.

LONG WET PERIOD.

To the Editor of the Meteorological Magazine.

SIR,—The *distribution* of the rain which fell between the 13th of February and 29th of March inclusive, 46 days, appears worthy of notice. The aggregate amount, though above the average, can hardly be considered very excessive, being 4·90 (or ·107 per diem), an amount which was exceeded in the 31 days of October 1872, 5·80 (or ·187 per diem), and July 1875, 5·20 (or ·168 per diem). The fall of rain has been recorded here since the beginning of 1872, the very wet year, but in that time, four complete years, I do not find so large a number of consecutive days on which rain fell. The nearest approach to it was in January last year, from the 8th to 27th inclusive, or 20 consecutive days; but in this year rain has been recorded every day from the 20th of February to the 15th of March inclusive—25 consecutive days—whilst from the 13th of February to 15th of March, it fell on 31 days out of the 32, and from the 13th of February to 29th of March, 40 days out of the 46.

Of course, by the term rain I include snow as well as rain—water in the gauge, in fact.—I am, Sir, yours faithfully, J. W. SCOTT.

Muswell Hill, Middlesex, N., April 1st, 1876.

REVIEWS.

Meteorologisk Aarbog for 1874, udgivet af det danske Meteorologiske Institut. Annuaire Météorologique pour l'année, 1874. Publiée par l'Institut Météorologique Danois. Sm. fol. Copenhagen: J. H. Schultz.

THIS is a capital work, quite equal to Capt. Hoffmeyer's usual high standard; for its contents, arrangement, printing, paper, language and illustrations we have nothing but praise, and yet in one respect we do not like it. We may be in error, but are certainly under the impression that one of the points settled by the Leipzig and Vienna meetings was that all ordinary meteorological publications were to be either large 8vo. or 4to. In the face of this, we have a member of the Permanent Committee issuing a book of which the pages are 11 in. long and $7\frac{1}{2}$ broad, and which, therefore, hardly ranges with any meteorological publication yet issued.

Having entered our protest against this departure from uniformity, nothing remains but the pleasureable duty of explaining as briefly as may be the nature of the volume. It consists of about 200 pages, mostly tabular matter, with an introduction, description of the stations, instruments, observations, &c., notes on the state of the sea, upon rainfall, &c. It is also well illustrated by numerous and readily intelligible maps, and also by an interesting series of monthly charts of isobars, isotherms and rainfall. The text is mostly printed in duplicate Danish and French; indeed, the only important exception is the article, "Oversigt over Vejrforholdene i 1874," or Summary of the Weather in 1874, and the capital little charts given with it, render it easy for anyone having a general acquaintance with the languages of North-West Europe to follow the text and profit by it.

The general scope of the work is well described in the introduction, of which the spirit is as follows. (We do not translate literally, as space necessitates extreme brevity).

"Conformably to the resolutions of the Vienna Congress and of its Permanent Committee, a new form has been adopted for the present work, not merely externally, but also as regards its interior arrangement. Moreover, we have tried the autographic method, both for the tables and maps, on account of its greatly reduced cost as compared with printed tables and engraved maps. The publication will in future be issued in two parts, that relating to the kingdom of Denmark as soon as possible after the close of each year, and the other embracing the returns from Faroe, Iceland and Greenland at a later date, viz., after the records arrive at Copenhagen.

In other respects the organization of the Danish system, and the mode of publication agree in almost all respects with the rules laid down by the Congress, for although sometimes tempted to travel a little beyond the rules laid down, the Institute recognizing the immense importance of a uniform mode of publication has subordinated everything to the attainment of that object."—N. HOFFMEYER.

After giving maps showing the distribution of the stations of the various classes, Capt. Hoffmeyer gives a very clear account of their organization, equipment and arrangements. There are 8 principal

stations, 27 climatological stations (thermometers and rain gauges only), and 87 stations for rainfall alone, so that altogether there are 122 rain fall stations, or about one gauge to each 121 square miles.

A supplementary set of maps and notes describe the 5 stations in Iceland, 4 in Greenland (one, the most northerly regular station in the world, Upernavik, in N. lat., $72^{\circ}47'$), and 7 in the Faroe Isles, and thus completes a book which is a credit to every one concerned with its production.

Water Analysis as it should, and as it should not, be performed by the Medical Officer of Health, by CORNELIUS B. FOX, M.D., M.R.C.P. Lond., &c. 2nd edition, with illustrations, post 8vo. Churchill.

DR. FOX is so thoroughly a writer after our own heart, he goes so straight to the point at which he aims, and so shuns redundant verbiage, that our best plan in noticing this work is to give one or two extracts, and merely a line or two of our own in comment. The Preface to the first edition was as follows:—

"The following paper was read by me, in the Public Medicine Section, at the Meeting of the British Medical Association, held at Norwich in August, 1874, to the principal Medical Officers of Health throughout the country, who, in a discussion that followed, endorsed its recommendations.

"It was not written for the instruction of *dummy* or *sham* Medical Officers of Health, who receive £5 or £10 a year as a salary, with the understanding that they are to do nothing.

"It was written: (1) for the purpose of inducing all *real* Medical Officers of Health to adopt some one reliable method of Water Analysis, so that the results of the examinations of all might be comparable; (2) to demonstrate to them the superiority of the Nessler process to any other for employment by the Health Officer; and (3) to give to them some of the results of my experience in the examination of potable waters.

"In order to make the paper useful to Sanitarians in general, several additions have been made to it, so as to render its contents a digest or *précis* of the most approved, and most rapid, reliable method of water analysis, freed altogether from lengthy and technical details, and illustrated with wood engravings."

"The elementary principles on which the greater part of the work of the Medical Officer of Health is based, may be truly said to be the prevention of water pollution, and of air pollution, with the products of decomposing filth. The examination of drinking waters form a very important portion of his duty in his crusade against preventable disease. He should not only be prepared to answer such a question as 'Does a water contain a deleterious amount of organic matter?' but should be able to reply to such interrogations as 'Is this water wholesome and good?' 'Which of several specified wells furnishes the purest water?' &c."

After some general remarks, Dr. Fox (who is himself Medical Officer of Health for E., Central, and S. Essex) proceeds to note the methods hitherto adopted, as follows:—

"Seven methods have been employed by different Medical Officers of Health throughout the country, in their attempts to pronounce on the quality of water. The practice of these methods has led, I am compelled to add, to most contradictory results.

1. By noting the presence or absence of any smell in the air with which the water has been violently shaken.

2. Heisch's Test.

3. The Zymotic or Microzyme Test.
4. The Permanganate of Potash Test.
5. The Horsley Test.
6. The Nessler Process.
7. Frankland and Armstrong's Process."

We can hardly indicate the straightforward plainness of language better than by extracting part of the author's remarks upon—

"1. *Smell of Water*.—The most rough-and-ready way that has been employed for ascertaining whether or not a water is polluted with organic matter, is to partly fill a clean bottle with a sample of it, and, having violently shaken the same, to take a hearty sniff at the air of the bottle which has been agitated with the water. If the air smells sweet and fresh, the absence of an injurious amount of organic matter is inferred and *vice versa*. There is no doubt but that much may be learnt in this way by those who do not blunt their sense of smell by smoking, especially if they frequently practise this primitive test. It is very easy to distinguish thus between river water and spring water; and a very impure water, which may exhibit no fault to the eye, may frequently disclose to the olfactory nerves the fact of its pollution."

¶ This is not the place, nor are we competent, to cross swords with Dr. Fox respecting his views of Dr. Frankland's process, but we do not share them.

In conclusion, we need only state that we should not have quoted so largely from Dr. Fox's work had we not thought it a good one, and a manual which should be on the shelves of all his brother officers who are not "dummies."

The Geographical Distribution of Heart Disease and Dropsy, Cancer in Females, and Phthisis in Females, in England and Wales, by ALFRED HAVILAND, M.R.C.S., &c. Imp. 4to. Smith, Elder & Co.

THIS is a very sumptuous work by another well known Medical Officer of Health. The first part of it was reviewed in these pages* some years back, and, with respect to the complete work, we have little to add to and nothing to retract from what we then said. The work is not quite within our province, yet it abounds with suggestive remarks on all kinds of subjects—medical, meteorological, social, architectural, geological, &c. By the bye, there is an amusing slip of the pen respecting a geological map, which on p. 80 is stated to be "on a scale of a mile to an inch," instead of "an inch to a mile." The following extract is a fair specimen of the original thoughts profusely scattered through this work:—

"The artificial granite formation is of high sanitary value, and the extent to which it has been laid on in the older parts of London, where the traffic is greatest, has, undoubtedly, had a wonderful influence on the local climate, and, therefore, on the public health; it is evident that the hygrometric and electrical condition of the atmosphere above a granite area, which favours the ready disappearance of the rainfall through the drains into the river, must be widely different from that floating over a macadamised clay area, or the air wafted from extensive enclosures of unmitigated and badly drained London clay, such as Regent's Park and Primrose Hill; spaces that might be made sources of health to the neighbourhood, instead of the birthplace of mists and fogs with their attendant evils."

* *Met. Mag.*, 1871, vol. vi., p. 120.

JOTTINGS ON NATURAL PHENOMENA IN 1875.

The following scraps have been extracted *verbatim* from the remarks upon the annual rainfall returns, and seem better adapted for insertion here than in *British Rainfall*. Many other items will be found in the remarks published monthly in these pages.

January.—13th. (XII.) Melrose : starlings seen in flock.—19th. Melrose : starlings disappeared.—20th. (IX.) Stanley : a frog seen.

February.—1st. (XVI.) Leny, Callander : heard thrush.—14th. (IX.) Stanley : fine day, sparrows pairing.—15th. Stanley : beautiful day, crocus in full bloom, and lark singing.—15th. (XII.) Melrose : starlings in flocks.—18th. Melrose : starlings disappeared.—17th. (IX.) Stanley : thrush singing.

March.—24th. (III.) Cambridge : butterflies first seen.—26th. Cambridge : apricot blooming well.—30th. (V.) Alderbury : thorn in green leaf.

April.—13th. (V.) Tytherton : Cuckoo first heard.—14th. (III.) Addington : swallow appeared.—15th. (II.) Bleak Ho., Hastings : cuckoo first heard.—16th. (I.) Pinner Hill : swallows came.—(V.) Alderbury : wryneck heard.—17th. Pinner Hill : nightingale, wryneck and cuckoo came.—(IV.) Diss : swallows first seen.—(V.) Alderbury : cuckoo heard, and swallow seen.—18th. (II.) Bleak Ho., Hastings : swallow first seen.—(III.) Addington : cuckoo appeared.—(III.) Cambridge : queen wasp seen.—19th. (III.) Cambridge : nightingale arrived.—(IV.) Diss : cuckoo first heard.—20th. (II.) Bleak Ho., Hastings : nightingale first heard.—(III.) Cambridge : swallow and cuckoo arrived.—22nd. (XVI.) Leny, Callander : sand swallows, and on 23rd, heard cuckoo.—29th. (XII.) Melrose : swallows appeared.

May.—1st. (XII.) Melrose : cuckoo arrived.—3rd. Melrose : land-rail heard.—16th. (XVI.) Leny, Callander : heard landrail.

June.—4th. (VII.) Calcethorpe, wheat in ear.—10th. (IX.) Stanley : corn shot.—18th. (II.) St. Lawrence, Isle of Wight, carted hay.—19th. (IX.) Stanley, hay making commenced.—22nd. (III.) Addington : haymaking general in this neighbourhood.

July.—31st. (IV.) Diss : wheat commenced, oats were cut some days previously.

August.—2nd. (IX.) Beverley : patches of wheat cut, but the general harvest delayed by the rain till the 16th.—5th. (II.) Swallowfield : harvest commenced.—10th. (IX.) Stanley : corn beginning to grow where it is laid.—(X.) Chester-le-Street : harvest became general towards the end of August, with a crop decidedly below the average ; fogs (the after-crop of hay) most excellent.

September.—5th. (II.) Swallowfield : oats still standing.—20th. (II.) Swallowfield : gathered some strawberries.

October.—3rd. (I.) Harrow : martins, after their early departure, returned, and stayed till the 18th.—9th. (VII.) Calcethorpe: swallows departed.—14th. (IX.) Stanley: swallows left.—21st. Stanley: two swallows seen here.—31st. (I.) Harrow: swallows were seen on this day.

November.—1st. (XVI.) Leny, Callander : a greater foliage on trees than I ever remember at same date.—2nd. (II.) Swallowfield : swallows left.—3rd. (IX.) Stanley : starlings singing.—8th. (I.) Harrow : fieldfares seen.—12th. Harrow : larks singing.—13th. Harrow : thrushes singing.—19th. (IX.) Stanley : thrush singing.

December.—9th. (IX.) Stanley : moths out and starlings singing.—12th. Stanley : hedge sparrow singing.—19th. Stanley : thrush singing.—25th. Stanley : Christmas rose, polyanthus, and jasmine in flower.—27th. (III.) Addington : jasminum nudiflorum beautifully in flower on the open walls.

SUPPLEMENTARY TABLE OF RAINFALL IN MARCH, 1876

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

Station.	Total Rain. in.	Station.	Total Rain. in.
Acol	2·33	Llanfrechfa	5·39
Hailsham	2·72	Castle Malgwyn	3·37
Andover	3·08	Heyope	4·59
Strathfield Turgiss	3·28	Rhug, Corwen	4·45
Addington Manor	3·60	Port Madoc	3·52
Oxford	3·27	Melrose	3·81
Cambridge	2·19	Cessnock, Glasgow	5·84
Sheering	2·63	Gruinart	4·28
Ipswich	2·75	Keith	4·01
Diss	3·24	Strathconan	11·58
Swaffham	2·70	Springfield, Tain	3·76
Compton Bassett	4·02	Skibbereen	2·59
Dartmoor	6·30	Glenville, Fermoy	4·99
Teignmouth	3·92	Tralee	4·72
Torrington (Langtree) ..	5·81	Newcastle W., Limerick ..	4·82
Trevarrick, St. Austell ..	5·44	Kilrush .....	...
Taunton	4·61	Kilkenny	3·18
Bristol .....	...	Kilsallaghan	2·27
Sansaw	2·16	Twyford, Athlone	4·07
Cheadle	3·66	Ballinasloe	3·68
Ashby-de-la-Zouch	3·24	Kylemore	8·24
Coston, Melton Mowbray ..	2·68	Bangor	7·13
Bucknall	2·53	Carrick on Shannon	4·13
Walton, Liverpool	2·18	Rockcory	3·87
Broughton-in-Furness ..	3·94	Warrenpoint	3·43
Stanley, Wakefield	3·41	Bushmills	4·49
Gainford	3·18	Buncrana	5·27
Shap	5·34		

MARCH, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ≥1 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth.	Date.					Deg.	Date.	Deg.	Date.
								Inches.	Inches.				
I.	Camden Town	2.96	+ .88	.74	12	22	63.3	31	26.4	22	8	16	
II.	Maidstone (Linton Park)	2.65	+ .16	.52	12	19	66.0	31	23.0	19	10	...	
III.	Selborne (The Wakes)	3.86	+ 1.26	.61	11	26	56.0	31	26.0	21	8	12	
IV.	Hitchin	2.97	+ .80	.79	12	20	56.0	31	22.0	21	18	...	
V.	Banbury	3.40	+ 1.20	.66	12	24	60.0	31	24.5	22	15	...	
VI.	Bury St. Edmunds (Culford)	2.10	- .10	.56	12	18	61.0	31	21.0	21	12	20	
VII.	N.wich (Sprowston)	2.92	...	.55	12	21	...	...	...	...	...	...
VIII.	Bridport	3.10	+ .23	.61	11	21	56.0	6	22.0	19	13	...	
IX.	Barnstaple	5.40	+ 2.25	1.40	11	21	56.5	4	28.5	23	...	...
X.	Bodmin	4.51	+ .76	.76	30	25	56.0	28	29.0	19	4	11	
XI.	Cirencester	4.39	+ 1.79	.92	9	20	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	2.45	+ .51	.33	14*	18	55.0	3	22.0	20	14	21	
XIII.	Tenbury (Orleton)	3.32	+ .90	.56	30	25	57.7	3	22.5	22	10	17	
XIV.	Leicester (Belmont Villas)	2.81	...	.52	27	24	63.5	31	25.2	19	11	...
XV.	Boston	2.42	+ .63	.62	27	17	64.0	31	25.0	19	11	...	
XVI.	Grimsby (Killingholme)	3.32	...	.99	27	25	58.0	31	24.0	19	10	...
XVII.	Mansfield	3.04	...	.44	8	24	63.2	31	24.6	19	15	17
XVIII.	Manchester	3.70	+ 1.01	...	...	22	...	...	...	...	...	...
XIX.	York	3.23	+ 1.24	.63	29	24	60.0	31	24.0	18	12	...	
XX.	Skipton (Arneliffe)	8.10	+ 3.29	1.15	8	23	...	...	...	...	...	...
XXI.	North Shields	2.02	- .33	.27	14*	23	55.0	3	25.0	22	11	22	
XXII.	Borrowdale (Seathwaite)	12.86	- .60	2.86	2	23	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	3.57	+ .12	.73	5	17	52.0	1+	25.0	22	13	18	
XXV.	Machynlleth	5.89	...	2.12	5	21	54.0	29	20.0	19	7	...	
XXVI.	Llandudno	2.89	+ .63	.60	5	16	56.6	3	26.2	18	...	...
XXVII.	Dumfries (Crichton Asylum)	3.59	+ .99	.48	2	17	52.8	1	22.0	20	18	19	
XXVIII.	Hawick (Silverbut Hall)	3.82	...	.76	14	18	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill)	5.12	...	.87	9	22	55.0	4	22.0	20	14	18
XXX.	Castle Toward	5.83	+ 1.24	.90	3	19	48.0	1, 3	25.0	23	14	...	
XXXI.	Mull (Quinish)	7.24	...	.84	25	23	...	...	...	...	...	...
XXXII.	Leven (Nookton) .....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	4.57	...	.63	3, 14	18	...	...	...	...	...	...
XXXIV.	Braemar	4.31	+ 2.10	.57	3	24	50.4	3	11.3	21	20	27	
XXXV.	Aberdeen	4.51	...	.70	10	27	52.2	3	22.4	13	10	23
XXXVI.	Loch Broom	6.75	...	.92	9	28	...	...	...	...	...	...
XXXVII.	Portree	7.89	- 1.15	1.37	3	26	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	4.01	+ 2.05	.64	10	27	56.0	3	21.5	17	11	26	
XXXIX.	Helmsdale	7.32	...	2.00	10	27	...	...	...	...	...	...
XL.	Sandwick .....	...	...	...	...	...	...	...	...	...	...	...
XLI.	Caherciveen Darrynane Abbey	4.48	...	.86	21	14	...	...	...	...	...	...
XLII.	Cork	3.63	...	.45	12	24	...	...	...	...	...	...
XLIII.	Waterford	3.67	+ .78	.56	20	24	61.0	12	28.0	13	10	...	
XLIV.	Killaloe	6.08	+ 1.76	.80	5	20	59.0	30	24.0	23	11	0	
XLV.	Portlannington	3.00	- .31	.33	3	27	54.0	2	28.0	18	14	...	
XLVI.	Monkstown, Dublin	2.47	- .11	.54	8	19	...	...	...	...	...	...
XLVII.	Galway	4.78	...	.73	4	24	55.0	2, 3	28.0	9	7	...
XLVIII.	Ballyshannon	3.16	...	.55	7	18	...	...	...	...	...	...
XLIX.	Waringstown	3.08	...	.39	5	26	59.0	3	26.0	11	19	23
L.	Edenfel (Omagh)	3.63	...	.42	2	25	50.0	30	22.0	9	16	...

* And 29. † 16 & 31. ‡ 19.

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON MARCH.

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.

SELBORNE.—Certainly the most inclement March I have ever recorded. Very little work either in fields or gardens. Prevailing winds the first fortnight, S.W., then variable W. and N. to N.E., last few days S.W. T with violent wind from S.W. on 4th; 9th, bar. fell $\cdot 971$ of an inch in 36 hours, followed on 10th by T, L, R, H & S, with high wind, all within ten minutes, at 9 a.m.; 17th, biting N.E. wind; a little S and H, frequent fog at the beginning and end of the month.

HITCHEN.—11th and 12th, the deepest fall of S we have ever recorded; S on 19th and 27th.

BANBURY.—High wind on 3rd, 5th, 8th, 14th and 18th, and soft H on 17th and 22nd; H on 6th, 7th, 8th, 15th and 29th; S on 9th, 18th, 19th, 21st and 27th.

CULFORD.—A month of exceedingly wintry weather with a mean temp. barely exceeding that of February, viz., $40^{\circ} 4$; easterly winds prevailed only on 8 days, but S fell more or less on 9 days; very high wind, accompanied by T, on 14th; T again on 28th; the lowest temp. was $21^{\circ} 0$, and occurred on 21st. A favourable change set in on the 30th, the max. temp. of the month $61^{\circ} 0$ being attained on 31st.

SPROWSTON.—A very wet month, nearly double the average, a large proportion of which fell as S; land so wet that barley sowing did not commence (except on the very highest soils) till the 27th; bar. very low from 8th to 12th; T clap and H at 1 p.m., and gusty on 6th; high wind on 10th, especially at 2 and 3; gale all day on 15th; snowstorm daily from 17th to 22nd inclusive.

BODMIN.—Heavy westerly gales on 9th and 12th; S daily 17th to 21st, inclusive.

SHIFNAL.—This has been a genuine March and unpleasant beyond measure, the whole of it after the first 5 days having been a combination or interchange of frost and snowstorms, wind and R. The ther. which stood at $55^{\circ} 0$ on the 3rd never reached that afterwards, and the frosty nights (14) and 21 on grass retarded vegetation, putting the farmers to great straits for keep and withering the young wheat crop. On the 28th thick fog came on, followed by heavy R at night; the temp. then rose from 42° to 49° , and finishing on the 31st at 54° . Gooseberry bushes burst on 5th, apricot in blossom on 12th, celandine in flower on 22nd, willow in bloom on 26th; humble bee first seen on 31st.

ORLETON.—R or S fell every day, with temp. generally low, and a cloudy sky till the 18th, then severe frosts and dry winds to the 28th, when a sudden rise of temp. took place, and the remaining days were wet and warm. The ground was frequently covered with S, and the bar. very low throughout the month; at 9 a.m. on 10th it stood at $28^{\circ} 42$ uncorrected. The mean temp. of the month was about the average. The rough dry winds enabled the farmers, between the 21st and 28th, to plant wheat on the soil that was too wet in the autumn.

LEICESTER.—A cold month, with the exception of a few days at the beginning and end; more frost and S than usual; bar. frequently very low; mean temp. $39^{\circ} 9$, being $0^{\circ} 6$ below that of February; owing to the heavy R of 27th and 28th, much land in the neighbourhood has again been flooded. Much T on 21st, at 6.35 p.m.

BOSTON.—One of the stormiest months known for many years; a gale raged almost continuously from the 3rd to 17th; the bar. has not reached to $30^{\circ} 00$ since the 4th February; several very strong frosts. Heavy R towards the end of the month, causing the river to rise very high.

GRIMSBY.—A severe and stormy month, with very low bar., only four days that could be called pleasant. "March dust" almost unknown; scarcely any spring corn sown. T and L at 11.15 a.m. on 6th, at 4.50 p.m. on 11th, at 7.15

p.m. on 28th, and T at 2.30 p.m. on 29th. Yew began to shed pollen on 1st, apricot began to flower on 3rd, violet on 8th, peach on 13th, and marsh marigold on 23rd. Frogs spawning on 20th.

MANSFIELD.—A cold, wretched month, the last day being the only really pleasant day in it; T, H and S at 1.30 on 15th.

ARNcliffe.—Loud peal of T on 10th, and frequent peals of T on 31st; a remarkable gloom on 29th.

NORTH SHIELDS.—Frequent S during the month; fog on 28th and 29th; T and L on 31st. White crocus in flower on 1st, purple and white saffrage on 10th, and double red hepatica on 11th.

SEATHWAITE.—Though R fell on 23 days, exceeding 1.00 in. on 4 days and 2.00 in. on 2 days, the max. fall being 2.86 in. on the 2nd, the total fall (12.80 in.) was rather *below* the average.

WALES.

HAVERFORDWEST.—A very rough, cold month; bar. very low from the 8th to the 12th; corrected reading, 9 p.m. on 9th, 28.6. Precell range covered with S on 10th; several heavy snowstorms; violent gale from N., and blinding S shower on the night of 18th; much L on the night of 9th. The most severe March in this county since 1865.

MACHYNLETH.—A very wet, cold and stormy month up to the 19th; very cold and dry with sharp frosts from that time to the 28th, then fine, but with white frosts in the mornings; T at 3 p.m. on 15th.

LEANDUDNO.—T and L with H at 7.45 p.m. on 6th; T and L with S during the night of 18th; jargonel pear in blossom on 21st, plum in bloom on 24th. S showers almost daily, and lying on the distant hills during the whole of the month. First two days fine, thence to the 21st cold and stormy; from 22nd to the end on the whole fine, the last four days especially so; nights of 18th, 19th and 20th frosty, being preceded by a heavy fall of S.

SCOTLAND.

DUMFRIES.—A very stormy month; rainfall above the average. The snowfall in this district comparatively light; the reading of the bar. on the 9th lower than any recorded at this station for 12 years; mean temp. 37°·7, one degree lower than last year; last two days much milder.

HAWICK.—A very stormy month; the 14th was a terrible day for R, H, S, frost and wind. The S and frost have retarded farming operations.

ANNANHILL.—Month very boisterous; several gales; prevailing winds westerly; great storm on 9th, with T and L; great fall of S during the month; from 17th to 29th, a period of easterly winds and frost; S and large H on 7th; showers of H and sleet on several days; ozone well developed, mean amounting to 6.9 and the max. recorded on 8 days.

CASTLE TOWARD.—The stormy weather of this month is quite unprecedented; S fell frequently, was deeper, and continued on the ground longer than during the winter months; frosts also were frequent, but were not of long continuance; altogether it has been a severe month, and promises a late spring. No seed yet sown; the ground being too wet. Grass is looking very brown, and there will be but little food for the cattle for some time to come.

BRAEMAR.—Bar. 27.126 in. on 9th, nearly two-tenths lower than I have recorded since I began to take observations (20 years). A most severe month, with S and drift.

ABERDEEN.—Mean bar. 29.328 in. or .474 in. below the mean of 19 years, and (except December, 1868,) the lowest mean for any month during the last 20 years; on 9th it fell to 28.035 in. corrected; mean temp. 1°·2 below the average; rainfall considerably above the average. A month of unusually stormy weather; agricultural operations are very far behind.

LOCHBROOM.—Scarcely one fair day ; all outside work much retarded ; sheep, &c., much reduced.

PORTREE.—A cold, stormy month ; S from 12th to 18th ; such a fall of S at this season of the year is unprecedented in this island ; a fresh fall of S (3 inches) took place on 27th ; gale from 7 a.m. till 11 p.m. on the 4th, from S.W. to N.W. ; the weather is still very cold, and outdoor work backward.

CULLODEN.—On the 8th, 9th and 10th, great depressions of the bar. took place, particularly on the 9th, when the mercury (corrected to 32° Fahr., at 104 ft. above the sea) sank by 7 p.m. to 27·966 in., having ranged below 28 in. for five hours previously. The following are the several corrected readings below this point :—4.30 p.m., 27·990 in. ; 5 p.m., 27·980 in. ; 5.15 p.m., 27·973 in. ; 6 p.m., 27·972 in. ; 7 p.m., 27·966 in., which was the minimum, and the greatest depression that has occurred since the 27th of December, 1852, when the extraordinary low reading of 27·872 in. was reached. On the 18th of January, 1872, however, there was a depression *nearly as great as on the 9th inst., namely, 27·968 in.* Fieldfares last seen on 23rd.

IRELAND.

DARRYNANE.—March has kept its proverbial character : it came in like a raging lion, and went out like a lamb ; from 1st to 11th inclusive it blew a gale of wind, with E, H, S and a very heavy sea ; on the 9th the low grounds were covered with S, which is very rare here ; from 11th to the end the wind was moderate, and sea calm ; 30th and 31st, very fine and warm ; winds first part S.W. to N.N.W. ; last part very variable. Farming operations much delayed at first, but now being rapidly carried on ; H daily from 6th to 10th inclusive.

MONKSTOWN.—The early part of the month very severe ; cold winds and frequent showers of S prevailing ; the last few days were milder.

GALWAY.—T and L on 2nd and 3rd ; S on 9th.

BALLYSHANNON.—The month, with the exception of the last three days, has been an unusually severe one. There was an extraordinary fall of R between 10 and 11 p.m. on the 7th, which but for its short duration might have caused serious damage ; the low temp. and frequent falls of H have kept back vegetation, and up to the close of the month little has been done towards potatoe planting ; high tides on 10th ; gale from W. with S and H on 12th, and again on 14th ; loud T at 7 a.m. on 15th ; H and S, with high winds N.N.W., on 16th.

WARINGSTOWN.—Very wet, cold and backward, hardly any sign of spring.

EDENFEL, OMAGH.—Weather of the month (except the last few days) extremely wet, cold, stormy and inclement, with more S than at any period of the winter, and without any of the usual easterly winds ; as a consequence, vegetation and agriculture are more backward than for many years at the same period.

APRIL SNOW IN THE ISLE OF WIGHT.

To the Editor of the Meteorological Magazine.

SIR,—Last night and this morning there was a fall of snow to the depth of about an inch, or rather more, the water in the gauge registering about 0·20 in. The trees were thickly covered, and presented a most enchanting appearance, and a most unusual one for the season. Maximum temperature, 45°. The snow did not fully melt for several hours. At 4.15 p.m., heavy fall of soft hail ; temperature, 39½°.

E. G. ALDRIDGE.

Newport, Isle of Wight, 12th April, 1876.

SYMONS'S

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EASTER AT THE SORBONNE.

PERHAPS some day it may come to pass that our University men may adopt the practice of an occasional return to College *not* as at present, chiefly for political purposes, but to discuss the results which they have attained in the various branches of research to which they have devoted themselves. Such a scheme reads like a Utopian dream when dressed in English language, and yet such (or something closely resembling such) a scheme has for many years been adopted in France. As regularly as Easter returns are the halls of the venerable Sorbonne filled, and is its great quadrangle dotted, with hundreds of *savants* gathered from even the remotest parts of France. And what has drawn them together? Certainly not politics. Probably, as in most things, the motives are mixed. (1) Nearly one hundred of them had forwarded memoirs to be read and discussed at the meetings, and doubtless the authors are as anxious as Englishmen would be to be present at the reading of their own papers. (2) There is an equally natural liking to hear the results which one's old comrades have obtained, and generally to stimulate the provincial brain, by contact with other labourers in the same field, and by a brief residence in the centre of French culture. (3) Superadded to the foregoing is the opportunity of that which, though it may be but "talk," is in many cases of immense importance; to quote but one illustration: Two men, A and B, meet; B mentions casually that he is thinking of trying certain experiments; A immediately says, "Oh, do not try them in that form, I did that five years ago and it failed, you would only waste your time, but try them in another form," which A forthwith describes to B. This is but "talk," but five minutes of such talk will often save weeks and even months of toil.

Before passing to our subject, we cannot refrain from stating that we believe that few persons realize the proportion of brain power wasted by duplicate and triplicate work. It would probably be one of the greatest benefits which could be conferred on scientific men, if there were any means by which they could ascertain what had been done before. The matter is, however, too important to be mentioned casually and buried in the middle of an article.

In the present and a subsequent article we purpose giving a general sketch of the proceedings of the recent meetings, but confining our notice of papers to those closely restricted to the domain of this publication.

The first meeting was a general one, presided over by M. Léopold Delisle, from the report of whose inaugural speech in the *Journal Officiel* we translate (or epitomise) the opening paragraph:—

“GENTLEMEN,—An experience of nearly fifteen years has indicated the object which the founders had in establishing the meeting to which the Minister of Public Instruction yearly invites the delegates of the learned societies of the Departments. Their utility is no longer questioned by anyone, and the forebodings to which they gave rise in certain quarters, are, little by little, vanishing away. Year by year their beneficial influence is more fully recognized; the members of the learned societies, whether they devote themselves to philology, history, archæology, or the mathematical, physical, or natural sciences, are now convinced that it is to their own interest to communicate their discoveries, and to stimulate a criticism which, by removing difficulties, and determining the progress actually made, is most beneficial to the advancement of their researches.”

M. Hébert, President of the Meteorological Committee of Limoges, read a paper upon the method adopted in la Haute Vienne, for the Agricultural Warning Service. At twenty-nine stations aneroid barometers have been established, and so placed as to be visible to the public. Each instrument is accompanied by a table of instructions, and forms, for the entry of the observations and for the publication of the weather expected. Rain gauges are also placed at the same stations. The telegraphic department allows all meteorological messages to go free, and therefore the despatches received from the central observatory are transmitted to all the stations, modified if necessary in accordance with the latest local observations.

M. Le Verrier desired meteorologists to consider the best mode of organizing the Agricultural Warning Service. He reminded them that France was the first country to organize storm warnings for the sea coast, and that now the majority of the storms passing over France are announced 24 hours in advance. Agricultural Warnings are, however, different; there are the differences due to the physical features of the district, and therefore it was desirable that observers should consult together as to the method to be adopted.

M. Poincarré, of Bar-le-Duc, gave a summary of his observations during 10 years.

M. le Dr. De Pietra Santa, after enunciating the principles which ought to regulate the modern study of climatology, stated that the winter resort of Ajaccio (Corsica), enjoyed a mild marine climate, intermediate between that of Algiers and that of the Mediterranean coast. The characteristics which he had assigned to Ajaccio in 1862 had been confirmed by 12 years' observations with instruments verified at the Observatory of Paris. The leading features are: great atmo-

spheric purity and uniformity, regularity in seasonal changes, slight barometric oscillation, mean annual temperature $63^{\circ}6$, mean winter temperature $57^{\circ}2$.

Among other papers read, or taken as read (they will all be published in the annual volume) were the following :—

Prof. Auzillion.—Discussion of observations of storms in 1875, in l'Herault.

M. L. Besnou.—On the importance of uniformity in the construction of barometers.

Prof. Lespiault.—The hailstorms of July 20 and 21, 1874.—Influence of the configuration of the country.

Prof. Raulin.—On the distribution of rain in the south temperate zone.

A paper was also announced by *M. Valada*, Professor of Rhetoric at the Lyceum of Roche-sur-Yon, with the rather sensational title, "Taches du soleil et localisation des atmosphères. Découverte d'un grand phénomène météorologique inconnu jusqu'à ce jour." Unfortunately we did not hear this paper read, and we have not been able to find any report of it in any of the French journals, so the great meteorological phenomenon must remain a little longer unknown.

(To be continued.)

SNOWSTORM ON APRIL 13TH.

Irrespective altogether of the time of year, the fall of snow on the above date was unusual, for it seems to have averaged nearly a foot, over several of the Midland counties. We have, therefore, much pleasure in giving the following ample notes upon the subject, in addition to those of our regular correspondents on pages 62—64.

SIR,—The snowstorm which has just ceased, must be, for the time of year, of almost unprecedented violence; at all events, I can find no record of anything like it in the 15 years during which I have taken observations.

The storm commenced about 5 a.m. yesterday, the 13th, and lasted with great violence till 7.30 a.m., by which time 4 in. of snow had fallen. The amount yielded by the rain gauge was .32 in. Slight showers of snow fell at intervals till 4.30 p.m., when the storm recommenced, and continued with more or less violence till 8 a.m. this morning, when the ground was covered to a depth varying from 2 to 6 inches. The yield in the gauge was .32 in, or equivalent to only about 4 inches of snow, owing, no doubt, to the high wind which prevailed throughout the storm.—Yours truly,

THOS. PAULIN.

Enfield, 14th April, 1876.

SIR,—A large portion of St. Catherine's Down, the highest point in this island, is covered with snow. Maximum temp. to-day about $40\frac{1}{2}^{\circ}$; very high wind from the N.W.; frequent snow showers.—Truly yours,

E. G. ALDRIDGE.

Alma House, Newport, Isle of Wight, 18th April, 1876.

SIR,—The snowstorm of Thursday night was marked by one circumstance which I have never witnessed before, though it may not be uncommon. It was this :—

On Friday morning I observed that for a considerable distance, and following a

regular line, the lawn, to leeward of the house, was strewed with masses of snow like boulders, varying from the size of a snowball, to a cubic foot at least, and as the snow melted a track either straight or curved led up to the large ones, following, apparently, the direction of the wind. I had observed before dusk that the eddies of the wind and the swirls of the snow were very marked, and I have since heard from a friend who observed the same thing, that he saw the snow rolled along by the wind, and forming masses such as I have described.

As I have said, I know not whether this has been observed in other cases, and perhaps it may interest you to have this account of it.—Yours faithfully,

F. WM. GREY.

Lynwood, Sunningdale, Staines, April 16th.

[We believe that this is the first instance recorded of the formation of "Snow Rollers" in England. They have been frequently observed at Sandwick in Orkney where Dr. Clouston has described them as cylinders resembling ladies' white muffs.—Ed.]

SIR,—Again has the oldest inhabitant been put in requisition, and he never saw such a fall of snow since 1813 as we had last Thursday. In the middle of April, *mirabile dictu*, except by rail, and the high road from London to Bedford, we have been entirely cut off from communication with the neighbouring villages. It commenced snowing in earnest about 2 p.m. on Thursday, and kept on all night, accompanied by a furious N. gale, all the conditions being precisely as in the case of the fall about five Sundays ago, except that the barometer which on the Sunday snowstorm was 28·37, last Thursday was 29·37. At about 7 o'clock on Thursday, all people leaving here by the two roads to the west, had to abandon the attempt, and carts, flies, &c., were left in the snowdrifts until yesterday. The doctor could not get to my farm, a mile from here. Another doctor summoned to a deathbed could not get to his patient until yesterday, when gangs of men succeeded in hewing a road through the snow, along which I walked yesterday afternoon for nearly a mile, the drift in some places being 6 feet deep. I fancy this fall has been very local, and has followed the valley of the Ouse. It has done frightful damage to evergreens and plantations. It does not show much in the rain gauge, as no doubt it thawed as it fell, but I can vouch for it being a foot deep on Good Friday morning where it had not drifted.—Yours truly,

W. LUCAS.

A fly-driver left his vehicle in a snowdrift about a mile from this, at a place called Offley Cross, and when they went in search of it, it was invisible—entirely hidden in the snow.

The Firs, Hitchin, Sunday, April 23rd.

SIR,—The weather during the last four days has been so extraordinary that I send you a few notes, showing what we have experienced here.

Date.	Wind.		Thermometers on stand 4 ft.				Ther. on grass	Snow.
	9 a.m.	5 p.m.	9 a.m.	2 p.m.	max.	min.		
April 11 ...	W.	W.N.W.	41·5	45·8	46·5	32·0	25·0	0·05
12 ...	N.W.	N.W.	35·0	37·2	42·5	28·8	22·0	0·25
13 ...	N.W.	N.	34·5	31·5	35·5	31·5	22·0	0·48
14 ...	N.N.E.	N.N.E.	34·5	36·5	41·5	31·0	28·0	0·04
15 ...	N.E.	...	41·0	...	...	32·0	29·0	...

* 5 in. rain gauge, 6 in. above ground.

REMARKS.

11th.—Thick snow and hail storms in the afternoon; cold and high wind.

12th.—Very cold. Sharp snowstorms at times all day; country quite white after some of them. In the night wind turned to S.E., with heavy snow.

13th.—Snow about $1\frac{1}{2}$ in. thick, though thawing. The wind very soon turned to the N. and became very high, and it was bitterly cold, with fine snow falling nearly all day till 6 p.m. ; snow much drifted in places. Quite a gale blowing in the night.

14th.—Gale, and thick snow 6 to 9 a.m., after which it became less, and ceased about 11 a.m. ; the wind also went down considerably, and a rapid thaw set in. The road near our house is impassable for carriages, the drifts being in many places 3 feet deep, right across the road.—Yours truly,

EDWARD C. MORRELL.

Broughton Lodge, Banbury, April 15th, 1876.

SIR,—I have to report a heavy snowstorm here this morning. It began about 4.30, and at 9 o'clock the snow was $4\frac{1}{2}$ inches deep on the level, and yielded 0.445 in. of water in the rain gauge. At 9 o'clock last night a snowstorm (4 in. deep) was reported as having occurred at Lynn, but the sky was then clear and the stars were bright here.

S. H. MILLER.

Wisbeach, 13th April, 1876.

SIR,—I must send you a note of the very remarkable weather we had at the end of the last week. Not to speak of the very singularly strong contrast with the very mild weather of the preceding week, the variations during the days themselves were most remarkable.

On Thursday, April 13th, the ground was covered with a sheet of snow 6 inches in depth ; it snowed incessantly the whole day long, but the quantity of snow had certainly diminished before the evening. Total yield, 2.08 in.

On Friday, the ground was wetter than I ever saw it, the roads were running streams, and all the low-lying land was under water.

On Saturday the roads were perfectly dry, and there remained only a few pools here and there on the meadows.

On Thursday, 9 a.m., the min. ther. marked $23^{\circ}6$; the max. in the evening, only reached $32^{\circ}6$. I do not think such coarse weather was ever before witnessed so late in the season.—I am, yours truly,

HENRY FFOLKES.

Hillington Rectory, Norfolk, April 18th, 1876.

SIR,—Though I am overwhelmed with parish work I must find time to send you a few notes of this extraordinary weather. We woke up this morning to find snow on the ground to the depth of 9 inches on the level ! We had a heavy storm, which lasted several hours, on Tuesday morning (11th), and a lighter fall early yesterday morning (12th), the ground on both occasions remaining covered generally till the afternoon, while the snow lingered in sheltered spots till night ; but the fall of to-day has been far beyond anything we have experienced this winter—for winter it is still, whatever the almanac may say. By 1 p.m. the depth of the snow had diminished, under the influence of wind and occasional sunshine, to 6 inches ; but we have just (2 p.m.) had another heavy snow-shower, and the appearance of the sky is still very threatening.

Ther. 36° , Wind N.E.—Yours truly,

GEORGE T. RYVES.

Tean Vicarage, Cheadle, Stoke-on-Trent, April 13th, 1876.

Readings of Thermometer at Tean Vicarage, Cheadle, Staffordshire.

	9 a.m.	Ther. in Glaisher stand.			mean.		On grass. min.
		9 p.m.	max.	min.			
April 10th	47°	34°	50°	34°·0'	41°·2	...	—
11th	33	32	42	29°·0	34°·0	...	31
12th	35	32	43	22°·5	33°·1	...	27*

* Ther. on grass covered with snow.

We have had a tremendous fall of snow. Taking several measurements this

morning, I found the average depth 8 inches, which had fallen since midnight. Snow has been falling most of the day, but a considerable quantity is melted now.
Wind N.E. H. BILLSON.

Leicester, 13th April, 1876, 7 p.m.

SIR,—It would be well perhaps for me to give you at once a few notes with respect to the extraordinary weather we have had during the last week. On Saturday, April 8th, the thermometer stood at 64°·5 in the shade, with a cloudless sky and a S.W. wind; it was like the beginning of summer; the bar., however, commenced to fall, and continued to do so until, during Monday, April 10th, it fell as low as 28°·85 (uncorrected). The temp. also decreased, and after a heavy fall of rain (0·53 in.) on Monday, we had a day of mixed snow and rain on Tuesday, and a bitterly cold wind on Wednesday (W.N.W. at 9 a.m.) and on Thursday we woke to find more than 10 inches of snow on the ground, the greater part of which had fallen since 3 a.m. The max. temp. this day (13th) was 34°·5, showing a range of 30° in five days. During the whole of Thursday it snowed heavily, but the wind also became very high, and although in some places the snow melted, in others the drifts became very deep and the roads blocked, so that they were utterly impassable by vehicles, and almost so by foot passengers; in fact I found great difficulty in reaching a sick parishioner. Even yesterday (April 16th) some of the roads were still impassable on account of the depth of snow, notwithstanding the sun and thaw of Friday afternoon, Saturday and Sunday. Such a snow at so late a period in the year is not remembered by any inhabitant of this place.

Yours faithfully,

A. M. RENDELL.

Coston Rectory, Melton Mowbray, April 17th, 1876.

SIR,—I was obliged to leave home on the 10th of April, and returned on the 17th. During my absence the rain is measured by my gardener, who is a remarkably intelligent, careful man. On the 12th and 13th we had a most remarkable fall of snow; on 13th, I am told, it was from 2 to 3 ft. deep where it had not drifted. When I came home on 17th, it was still very deep in many places. My gardener says he carefully measured the snow (which had not drifted where the gauge was), and he made it equal to—on 12th, 1·00 in.; on 13th, 4·25 in. of rain.

He declares that there could be no mistake, but it seems to me to be almost impossible; at least, I never remember anything like it before.

I send you the return for April here.—I am, yours truly,

C. O. EATON.

Tolethorpe Hall, Stamford, May 1st.

P.S.—We have another large flood, making, I believe, the twelfth since last July.

	in.		in.
April 1	·03	April 21	·10
„ 10	·39	„ 22	·12
„ 11	·02	„ 23	·03
„ 12 (snow)	1·00	„ 24	·14
„ 13 (snow)	4·25	„ 25	·11
„ 14 (snow)	·04	„ 26	·01
„ 16	·06	„ 27	·26
„ 18	·06	„ 29	·96
„ 19	·03		
„ 20	·08		
		Total...	7·69

SIR,—I take the liberty of writing to you respecting this week's snow storm. On Thursday, 13th inst., at 9 a.m., the snow on the level measured from 9 to 9½ inches deep. After that, owing to drifting, it was impossible to arrive at the true depth, but I imagine if there had been no wind the depth of snow would have been upwards of a foot. It was the heaviest fall I ever remember to have seen

(say embracing a period of 35 years); the nearest approach to it was in Suffolk, January, 1861, when the fall on the level was from 11 to 11½ inches.

I had no service yesterday owing to the snow. The baker has just informed me that this morning he was unable to reach a neighbouring village owing to the snow drifts.—I remain, Sir, your obedient servant,

J. S. SWIFT.

Thorpe Arnold, Melton Mowbray, April 15th, 1876.

P.S. None of the rural postmen were able to leave Melton Mowbray yesterday morning (Friday), with the exception of the Thorpe Arnold man, who told me that he was over knee deep in several places. Thorpe is distant from Melton a mile and a half.

SIR,—I send you an extract of the temperature from my Meteorological Register for the six days—11th to 16th April :—

Date.	Min.	Max.	Date.	Min.	Max.
April 11	32°	43°	April 14	32°	44°
„ 12 ...	30	44	„ 15	32	50
„ 13	29	37	„ 16 ...	31	50

The mean temperature of the period was 37°·8. The 13th and 14th will long be remembered for one of the most violent snowstorms that has visited this country for many years; whilst anything approaching such a storm in April cannot be remembered by the oldest persons. The snow commenced about 3 a.m. on 13th, and lasted 1½ hours without intermission. The wind began to blow strongly about 11 a.m., and continued to gather strength during the remainder of the day and night, and about midnight of 13–14th snow again began to fall heavily, and continued to 7 a.m. of 14th, accompanied the whole time by a hurricane of wind from N.E., which drifted the snow on the brows of some of the Wold hills to a depth of not less than 15 feet. The amount collected by the gauge was only 0·65 inch, but judging from the height of the flood there could not have been less than 1 inch of rain. I compute the depth of snow fallen to be twelve or thirteen inches.—Yours truly,

WILLIAM CARTER.

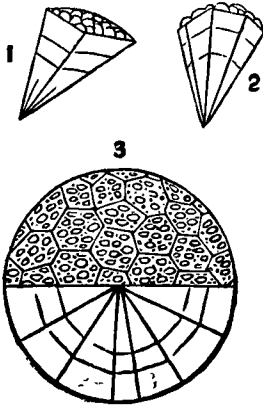
Bucknall, Horncastle, 1st May, 1876.

HAILSTORM AT LEAMINGTON.

To the Editor of the Meteorological Magazine.

SIR,—I beg to send you the accompanying memoranda respecting the heavy fall of hail at Leamington, on the afternoon of March 31st last, which I had the opportunity of witnessing, when present there for a few days. The hail fell from a thick heavy nimbus, coming from the S.E., while the sun in the W. was not obscured. It fell thickly for about 20 minutes, with much noise, both in the air, and from the roofs and trees, and splashed the river considerably on the surface. Everybody ran into shelter, as well they might, considering the size of the stones, which were as big as pebbles, angular, and pointed. They appeared to be shaped like pyramids, with points, and convex bases, studded with tubercles, and had plain sides, either square, pentagonal, or hexagonal. They would have probably belonged to complete spheres, when their sides were adjusted together, and which would have been about 1¼ in. in diameter, and these segments were, therefore, about ½ in. long. They were of crystalline ice, with concentric bands, and probably the perfect pyramids weighed from 10 to 20 grains, and, as 24 might

be estimated to make up a sphere, this, at the least, might have been half-an-ounce in weight, and at the most about one ounce. As they were tuberculated on the convex bases, the whole sphere would have looked very much like a raspberry, or an oxalate of lime calculus. These spheres of ice must have burst, or become split up into segments somewhere in the fall through the air, as none were actually found perfect on the grass in the gardens. The primitive spheres must have



- 1.—Pyramid with square base.
- 2.—Pyramid with hexagonal base.
- 3.—Perfect sphere, with lower half in section to show fragments.

been formed at great elevations, to have allowed of such a large accretion of ice from the original snow in the clouds.

The damage at Leamington, as may be supposed, was considerable in glass, plants, and blossoms, but it was fortunately only of a local character.

W. T. BLACK.

2, George Square, Edinburgh, April 23rd, 1876.

[In Vol. II., p. 30, of this Magazine, and in other places, these pyramidal hailstones have been figured, but to the best of our knowledge, Mr. Black is the first to suggest that they are fragments of spheres. The nearest approach to it which we remember, was the remark by Mr. Prince (*Meteorological Magazine*, Vol. VIII., p. 43)—“The balls were about the size of ordinary marbles. . . . They were very light, and broke into fragments upon the slightest touch.” Is Mr. Black’s theory to be accepted? because, if so, surely they ought to have fallen with great impetus.]—Ed.

THE GREAT CHANGES OF WEATHER IN APRIL.

To the Editor of the Meteorological Magazine.

SIR,—I do not know what kind of summer is prognosticated by the weather prophets this year. I desire to bring before the notice of the readers of your Magazine, the remarkable *similarity* of the changes in weather of the *two Aprils*, 1859 and 1876. In 1859, the temperature on the 1st was, in many parts of England, 8° below the freezing point,

followed by a heat of 75° in the shade on the 6th and 7th, succeeded once more by extreme cold, snow showers falling in Cambridge at mid-day on the 16th. This weather in April, 1859, preceded a remarkable fine and hot *July*.—Yours truly,

G. WARREN.

Merton Villa, Cambridge, May 4th.

FALL OF A METEORITE IN SHROPSHIRE.

To the Editor of the Meteorological Magazine.

SIR,—I enclose a cutting from our local newspaper, containing an account of the fall of a meteorite. However interesting it may be to read of these wonderful phenomena, and however sure we may feel of their genuineness, it is very gratifying to have an occurrence of the kind in one's own neighbourhood. I may say that all the parties named are so well known and so highly respectable, that the correctness of every detail in the account may be implicitly relied upon.

The very peculiar noise accompanying the fall was distinctly heard, and commented upon here, 7 miles off, by a party of cricketers, and others who happened to be away from the noise of the town. The piece of metal weighs 7½ lbs., is of very irregular shape, quite smooth, the angles rounded. As I looked upon it, I tried to realize the idea that I held in my hand a substance which had, a few hours previously, and probably for ages before, been whirling through space with planetary velocity.—Yours very truly.

JOHN THRUSTANS.

Merridale, Wolverhampton, April 26th, 1876.

STARTLING OCCURRENCE NEAR WELLINGTON.—FALL OF A METEORITE.

Great consternation has been caused amongst the villagers within a seven-mile radius of the Wrekin, by a phenomenon which occurred in that locality on Thursday afternoon. About twenty minutes to four o'clock, a strange rumbling noise was heard in the atmosphere, followed almost instantaneously by a startling explosion, resembling a discharge of heavy artillery. There was neither lightning nor thunder, but rain was falling heavily, the sky being obscured with dark clouds for some time, both before and after the incident narrated. About an hour after the explosion, Mr. George Brooks, step-son of Mr. Bayley, had occasion to go to a turf field in his occupation, adjoining the Wellington and Market Drayton Railway, about a mile north of Crudgington Station, and seven miles north of the Wrekin, when his attention was attracted to a hole cut in the ground. Probing the opening with a stick, Mr. Brooks discovered a lump of metal, of irregular shape, which proved to be a meteoric stone, weighing about eight pounds. This strange visitor had penetrated to a depth of eighteen inches, passing through four inches of soil and fourteen inches of solid clay, down to the gravel—conclusive evidence of the force of its impact with the earth. The hole (which has been protected for further investigation) is nearly perpendicular, and the stone appears to have fallen in a south-easterly direction. Some men were at work at the time within a short distance, and they, together with many other people in the neighbourhood, heard the noise of the explosion. Mr. Gibbons, of Tettenhall-road, Wolverhampton, has very kindly favoured us with a view of the meteorite, which he proposes submitting to the Birmingham Natural History Society.

MEETING OF THE VIENNA PERMANENT COMMITTEE.

THE Permanent Committee of the Vienna Meteorological Congress, has just held its third meeting in London, which lasted from the 18th to the 22nd April, inclusive. The members present were: Professors Buys Ballot (Holland), President; Bruhns (Germany); Cantoni (Italy); Mohn (Norway); Wild (Russia); and Mr. Scott; Professor Jelinek (Austria), was unavoidably absent, owing to ill health.

Among numerous subjects for consideration, it appeared that the scheme for publication, in a uniform manner of actual observations, and monthly results, from a limited number of stations in each country, which are to be considered as international, had been already accepted, almost without exception, or suggestion of improvement, by all the countries which had been represented at Vienna. It is hoped that this measure will ultimately tend to bring about uniformity in hours and methods of observation.

In weather telegraphy, it was resolved to calculate gradients in the metric scale as millimetres per one degree (60 nautical miles). In this country they will be referred to our units. It was not found practicable to introduce uniform hours for observations in connection with weather telegraphy in Europe at present. As to weather charts, a proposal for the exclusion of all meridians, except that of Greenwich, was postponed to the next Congress.

It was resolved to take advantage of that meeting to attempt to effect the comparison of the principal standard barometers by means of travelling barometers, to be conveyed to the place of meeting, and left there for a considerable time.

It was recognised as impracticable at present, to create an International Meteorological Institute, and consequently, it was decided that international investigations must be carried on at the expense of individual nations, all other nations to be requested to furnish materials, as far as possible, in a usable form. A list of upwards of 200 subscribers to the international synoptic weather charts of Captain Hoffmeyer was announced.

Resolutions were adopted in favour of the establishment of stations on high mountains, and in distant localities, and M. Weyprecht's proposition, for a circle of observing stations in the Arctic regions, round the Pole, was recognised as scientifically of high importance, and deserving of general support.

With reference to universal instructions for observations, it was stated that no general form of instructions could be drawn up to suit all climates, and it appeared to the committee that the instructions recently prepared in the German, Russian, and English languages, as well as in Italian (when some contemplated modifications should have been introduced), were sufficiently in accordance with the requirements of the Vienna Congress. It was hoped that ere long, French instructions of the same tenour would be issued.

It was announced that the Italian Government was prepared to

invite the next Congress to meet at Rome, in September, 1877, and the proposal was most gratefully accepted. In preparation for this meeting, a number of reports on the present state of the different departments of the science are called for, from various meteorologists. The questions to be treated in these reports are mainly instrumental, and they are of great importance in the present state of the subject. The detailed report of the committee will be published without delay.

BOOKS RECEIVED.

- Hassard, R., C.E.—On the Future Water Supply of London. 8vo. Stanford, 1876.
- Lawes, J. B., F.R.S.—On the Amount of Water given off by Plants during their growth. 8vo. 1850.
- „ „ —On the comparative evaporating properties of Evergreens and Deciduous Trees. 8vo. 1851.
- „ „ and Gilbert, J. H., F.R.S.—Effects of the Drought of 1870 on some of the Experimental Crops at Rothamsted. 8vo. 1871.
- Manchester, Sheffield, and Lincolnshire Railway.—Monthly Statement of Rain fallen in the year ending 31st December, 1875.
- Marriott, W.—On the Reduction of Barometric Readings (from the Quarterly Journal of the Meteorological Society). 8vo.
- Meteorological Committee.—On the Physical Geography of the part of the Atlantic which lies between 20°N and 10°S, and extends from 10° to 40°W, by Capt. Toynebee. 8vo. 1876.
- „ —Quarterly Weather Report, April–June, 1874. 4to. 1876.
- Miller, S. H., F.R.A.S.—The Fenland Meteorological Circular and Weather Report. March and April, 1876. 4to.
- Muirhead, H., M.D.—On the Current Doctrines of Attraction and Energy, and an Appendix. 8vo.
- „ „ —On the Genesis of Atoms, Worlds, and Sunspots. 8vo.

REVIEWS.

Report of the Kew Committee for the Year ending Oct. 31st, 1875. 8vo.

WE have not the faintest notion of whom the Kew Committee consists; it is not, perhaps, a very important matter, since for all their faults and for all their good deeds we presume the body by whom they are appointed, viz., the Royal Society, is responsible. Still, there can hardly be any reason against their names being given in the same form as that of the analogous body who superintend the Meteorological Office.

The examination of the photographic records of the seven observatories of the Meteorological Office is still carried out at Kew, the office paying the Committee £650 per annum for so doing; but there is nothing to show to which of the bodies this transaction is profitable.

We think that it is a pity that the Kew reports never give any meteorological results. We are told from time to time of such and such pieces of work being undertaken; we know that for many years observations have been regularly made, but except some little tables in that very scientific journal, the *Illustrated London News*, and in the *Quarterly Weather Reports* of the Meteorological Office, we do not recollect any publication of meteorological results. Indeed, we cannot remember ever seeing the name of the superintendent attached to any scientific communication whatever; but if Mr. Jeffery is unwilling to bring forward results himself, he might allow his assistants to do so.

We are very glad to find that the number of instruments verified during the year is rising steadily. It was as follows:—

Barometers.....	193	Hydrometers.....	150
Aneroids.....	21	Rain Gauges	3
Thermometers	2761	Dial Anemometers.	6

SUPPLEMENTARY TABLE OF RAINFALL IN APRIL, 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	1·96	Llanfrechfa	3·86
Hailsham	2·25	Castle Malgwyn ..	2·79
Andover.....	2·52	Heyope	3·72
Strathfield Turgiss	1·98	Rhug, Corwen	4·43
Addington Manor.....	3·86	Port Madoc	4·40
Oxford	2·78	Melrose	3·42
Cambridge.....	2·14	Cessnock, Glasgow	1·90
Sheering	2·17	Gruinart	1·75
Ipswich	1·61	Keith	2·21
Diss	1·73	Strathconan	3·47
Swaffham	3·44	Springfield, Tain	2·35
Compton Bassett	3·42	Skibbereen	4·75
Dartmoor	7·25	Glenville, Fermoy	3·86
Teignmouth	2·91	Tralee.....	2·89
Torrington (Langtree) ..	3·76	Newcastle W., Limerick	2·49
Trevarrick, St. Austell..	3·82	Kilrush .....	...
Taunton.....	3·22	Kilkenny	2·24
Bristol .....	...	Kilsallaghan	1·87
Sansaw	2·67	Twyford, Athlone	2·59
Cheadle	4·07	Ballinasloe.....	2·48
Ashby-de-la-Zouch	3·41	Kylemore	6·85
Coston, Melton Mowbray	4·18	Bangor	4·20
Bucknall	3·75	Carrick on Shannon.....	2·63
Walton, Liverpool	2·79	Rockcorry	2·18
Broughton-in-Furness ..	3·94	Warrenpoint	2·67
Stanley, Wakefield	2·33	Bushmills	2·03
Gainford	2·69	Buncrana	2·89
Shap	2·83		

APRIL, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which 1/10 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.		In shade	On grass		
				Dpth	Date.		Deg.	Date.	Deg.	Date.				
inches	Inches.	in.			Deg.	Date.	Deg.	Date.						
I.	Camden Town	1·90	+ ·77	·37	10	11	71·1	8	30·7	12	3	11		
II.	Maidstone (Linton Park)	1·93	+ ·71	·45	10	10	71·0	5, 8	28·0	13	2	...		
„	Selborne (The Wakes)	3·26	+ 1·76	·81	10	17	62·2	4	31·0	2, 3	3	8		
III.	Hitchin	2·81	+ 1·81	·51	13	18	62·0	8	25·0	15	9	...		
„	Banbury	2·71	+ 1·55	·56	13	21	67·0	8	29·0	12	6	...		
IV.	Bury St. Edmunds (Culford)	2·27	+ 1·52	·59	13	17	66·0	4	26·0	12	8	11		
V.	Norwich (Sprowston)	2·93	...	·70	25	17	...	...	...	...	...	...
„	Bridport	2·59	+ 1·11	·41	29	13	...	...	...	...	...	...
„	Barnstaple	2·83	+ ·82	·40	10*	16	67·0	8	33·5	1	...	...
„	Bodmin	3·85	+ 2·15	·43	9	18	61·0	7	33·0	11	0	8		
VI.	Cirencester	3·71	+ 2·42	·82	12	17	...	...	...	...	...	...
„	Shifnal (Haughton Hall)	2·62	+ 1·47	·56	12	16	62·0	6, 8	27·0	12†	8	9		
„	Tenbury (Orleton)	3·07	+ 1·53	·41	10	20	68·7	8	28·0	16	7	12		
VII.	Leicester (Belmont Villas)	2·83	...	·66	12	20	70·0	8	29·0	12	6	...		
„	Boston	4·36	+ 3·39	1·47	13	19	71·0	8	30·0	12	...	...
„	Grimsby (Killingholme)	2·27	...	·39	10	19	65·5	8	30·0	12	3	...		
„	Mansfield	2·68	...	·41	10	21	69·5	8	24·9	16	8	9		
VIII.	Manchester	3·16	+ 1·40	...	...	17	72·0	8	28·0	12	4	8
IX.	York	1·62	+ ·52	·55	10	12	68·0	7	28·0	15	6	...		
„	Skipton (Arncliffe)	3·49	+ ·45	·72	10§	20	...	...	...	...	...	...
X.	North Shields	3·21	+ 1·90	·98	28	19	63·0	27	27·5	13	4	8		
„	Borrowdale (Seathwaite)	6·04	— ·86	·93	9	15	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
„	Haverfordwest	2·63	+ ·77	·75	10	12	59·5	5	28·5	1	8	11		
„	Machynlleth	3·46	...	·75	9	18	67·0	8	28·0	13	6	...		
„	Llandudno	3·08	+ 1·58	·83	9	12	65·3	4	31·9	...	1	...		
XII.	Dumfries (Crichton Asylum)	2·70	...	·71	24	15	62·6	8	23·5	13	7	9		
„	Hawick (Silverbut Hall)	3·62	...	·88	28	12	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill)	1·10	...	·29	9	14	60·8	9	22·1	13	6	12		
XV.	Castle Toward	2·47	— ·03	·64	28	15	57·0	6	26·0	13	4	...		
XVI.	Mull (Quinish)	2·58	...	1·03	14	14	...	...	...	...	...	...
„	Leven (Nookton) .....	...	...	...	...	...	...	...	...	...	...	...
„	Grandtully	2·25	...	·58	27	9	...	...	...	...	...	...
XVII.	Braemar	2·52	+ 1·12	·42	27	15	59·3	6	17·0	13	10	18		
„	Aberdeen	2·92	...	·51	18	13	62·5	8	24·4	13	5	11		
XVIII.	Loch Broom	3·07	...	·65	8	22	...	...	...	...	...	...
„	Portree	4·37	— ·90	·83	14	25	...	...	...	...	...	...
„	Inverness (Culloden)	2·28	+ ·81	·47	12	22	59·4	8	28·0	13†	6	13		
XIX.	Helmsdale	2·98	...	·65	8	18	...	...	...	...	...	...
„	Sandwick	2·23	+ ·49	·40	8	19	55·0	3	25·6	13	3	10		
XX.	Caherciveen Darrynane Abbey	4·80	...	·61	2	19	...	...	...	...	...	...
„	Cork	3·30	...	·72	24	15	...	...	...	...	...	...
„	Waterford	2·76	+ ·53	·41	9	20	63·0	5, 19	30·0	8	5	...		
„	Killaloe .....	...	...	...	...	...	...	...	...	...	...	...
XXI.	Portarlington	2·35	+ ·33	·42	28	23	64·0	4	27·5	12	5	...		
„	Monkstown, Dublin	2·05	+ ·41	...	...	14	...	...	...	...	...	...
XXII.	Galway	3·74	...	·35	9	21	65·0	9	28·0	11	4	...		
„	Ballyshannon	2·03	...	·40	11	13	...	...	...	...	...	...
XXIII.	Waringstown	1·97	...	·33	10	16	66·0	17	23·0	12	9	...		
„	Edenfel (Omagh)	2·23	...	·79	27	19	59·0	4	24·0	12	10	13		

* And 11. † 16. ‡ 23. § 24.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON APRIL.

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.

SELBORNE.—A bleak yet damp month; very retarding to farm and garden work; between the 13th of February and end of April it rained on 63 days out of the 78. Fogs frequent during the month; white frost on 2nd; R all day on 10th, and S at night; heavy storm at 9 a.m. on 12th; H and S in after part of the day; snowstorm and high wind on 13th; and S and sleet on 14th. First swallow on 9th, and first martin on 10th.

HITCHEN.—S on 13th; the deepest on record, and remaining in some places till the end of the month.

BANBURY.—S daily from 11th to 14th. Cuckoo heard on 21st.

CULFORD.—A month of exceedingly variable weather, being for a few days almost like summer, and changing suddenly to weather of quite a wintry character. Polar winds prevailed on 13 days; S on the 11th, accompanied with almost total darkness; S fell also on 12th, 13th and 14th; TS, with H, on 25th. Cuckoo first heard on 22nd; nightingale first heard on 26th; and swallows seen on 29th.

SPROWSTON.—A very wet month; heavy fall of S on 12th and 13th, with high wind. TS, with heavy R, at 1 p.m. on 25th.

BRIDPORT.—S on 11th.

BODMIN.—Very severe weather on 11th, 12th, 13th and 14th, the last named being the most trying day in the winter. Average temp. of month $50^{\circ}3$.

SHIFNAL.—For the first nine days the month was warm and dry, the max. ther. never sinking below 50° , and min. only recording two frosty nights, 2nd and 5th. On 9th R set in, and the temp. fell on the 11th from $53^{\circ}0$ to 41° , followed on 12th by sleet, and at night by nearly 5 inches of S from N.W., making .56 in. of fluid. On the 18th ther. rose again to 54° , continuing to rise slightly to the close, and R falling daily, with the exception of the 25th, 30th and 31st. The bright green hedges laden with S on the 13th, and the hollies still red with berries were a curious sight. Wood anemone in flower on 5th; blackthorn in blossom on 8th; and wild cherry on 21st. The chiff chaff heard on 7th; sand martins seen on 15th, and cuckoo heard on 21st. First white butterfly seen on the 10th.

ORLETON.—The first eight days were dry, and generally fine and pleasant. Storms of S and R then set in till the close of the month. Much S fell between the 10th and 15th, frequently covering the ground, and the month upon the whole was very cold, wet and wintry. The average temp. was the same as that of last April, being nearly $2\frac{1}{4}^{\circ}$ below the average for the month. Many peals of T were heard on 28th. The cuckoo was first heard on 19th, and generally about the 23rd; the chiff chaff first seen on 19th; martins on the 10th; white throats, redstarts and swallows on the 27th. Cherry trees and damson trees came into blossom about the 10th.

LEICESTER.—Very fine during the first week, the temp. reaching to 70° on the 8th. Very heavy fall of S on 13th, which commenced at 1 a.m., and continued till 5 p.m., the greatest depth being 8 in.; the max. temp. only rising to 36° on this day. S also fell for some hours on the 14th, but a considerable quantity had melted by the evening; some of the roads in the eastern parts of the county were quite impassable, the drifts in some cases being nine feet deep, and postal communication was stopped for two days; the latter part of the month was stormy and unsettled, and the max. temp. on the last day was only $46^{\circ}5$. Mean temp. of month $46^{\circ}6$.

BOSTON.—A very heavy fall of S, with a strong gale from the N.E. on 11th, 12th, 13th and 14th; the snowstorm began about 2 a.m. on 12th, and continued without abatement for the next 26 hours, then came a lull for a few hours, when it began again; during part of this time the flakes were the largest ever seen,

being the size of a five-shilling piece. The country presented a singular appearance, the hedges in full leaf, and the ground coated a foot deep with S. The weather of Thursday and Good Friday morning was the most bitter and severe of any that has occurred during this long and protracted winter. The rainfall was 2.43 in. above the average of the last 20 years; the temp. $1^{\circ}7$ below the average.

GRIMSBY.—A week of mild and delightful weather at the opening of the month, the remainder was cold, cheerless, and unsettled. We caught only the tail of the great snowstorm that visited the Midland counties. Air remarkably dry on 8th; T at 2.55 p.m. on 9th; T during most of the afternoon on the 21st; and T and L on 25th. Sprinkling of S on the ground on the morning of 12th, and the ground covered at night; showers of S through the day of 13th, but it did not lie. Cowslips began to flower on 7th; the sloe on the 8th. Swallows seen on 23rd; cuckoo heard on 26th.

MANSFIELD.—A most remarkable month, commencing with beautiful spring-like weather, which suddenly changed during the night of the 10th, and a considerable fall of S took place, which was, however, but the prelude to a much heavier fall on the night of the 12th, when nearly 4.00 in. covered the ground; since then the weather has been cold, damp and cheerless, with the exception of a few gleams of sunshine. Vegetation is very backward, the hedges were scarcely green at the close of the month, and the flowers few and far between.

NORTH SHIELDS.—Cherry in blossom on 19th; pear in blossom on 22nd.

SEATHWAITE.—S and sleet on 9th and 10th; the max. fall of month was on the 9th, and was less than 1 in. (.93 in.); a most unusual thing to occur at Seathwaite.

WALES.

HAVERFORDWEST.—First three days cold, fine, and frosty, then some rain. From 11th to 16th very wintry, and much snow. A stormy period succeeded, after which to the end of the month the weather was fine and genial. A backward spring.

MACHYNLLETH.—A few very warm days at the beginning of the month, afterwards very cold and stormy, with much H, frost and S; altogether very stormy to the 13th, better after, but very cold at times, and I consider that everything is late for the season.

LLANDUDNO.—Weather fine for the first eight days, from thence a cold period to the 15th, with frequent S and H showers; the lowest night temp. (31.9 in.) was registered on 13th. From 19th to 29th the weather was showery, but the temp. was equable. Rainfall much above the average. Swallows seen on 14th. Apple in blossom on 20th.

SCOTLAND.

DUMFRIES.—A cold ungenial month, except during the first week, when the weather was mild and dry. S fell on the 10th, and H showers were frequent. T S on 19th, latter half of the month very wet. S.E. and E. winds prevailed almost continuously from 19th to the end. Mean temp. ($44^{\circ}3$) 2° lower than last year.

HAWICK.—A very cold frosty month; S and H on 9th, 10th, 13th, 21st, 29th and 30th; the hills continuing white with S, and on May-day we had rattling H showers and cold east winds. The farmers all say that they never saw a more unfavourable lambing season.

ANNANHILL.—Young oats and hay looking well now, but all farm work has been much retarded by the severe weather of February and March. Deciduous trees and fruit trees of all kinds very backward. The cattle disease has again shown itself, but otherwise the cattle are healthy.

CASTLE TOWARD.—A few good growing days at the beginning of the month, but afterwards cold winds set in, which retarded vegetation very much; this will be a backward season in this district, seeds in many cases having had to be sown over again.

BRAEMAR.—An unusually severe month, so much so that farming operations have not been so late since 1826. No progress in vegetation, a very late harvest anticipated.

ABERDEEN.—The first eight days were unusually fine and mild, the remainder of the month cold, rough, and variable. Bar. pressure and temp. below the average, and rainfall above it. Ground white with S on May Day morning; fogs frequent from 7th to the end of the month; H and S daily from 10th to 14th inclusive; T on early morning of the 9th. Min. temp. on grass $21^{\circ}4$ in. on 13th.

LOCHBROOM.—The month was cold, stormy, and wet.

PORTREE.—The coldest April on record. Ground covered with S from 10th to 14th inclusive, with sharp frosts at night, and strong bright sun in the day. The cold has caused fearful havoc among the lambs.

SANDWICK.—April has been a very cold month, and vegetation is very backward. The great E of March and the cold of April kept the soil so wet that agricultural and horticultural operations were prevented till the end of the month. The ground was white with S on 10th, 11th, 12th, 13th, 22nd and 30th; T in afternoon of 29th, and aurora on 11th.

IRELAND.

DARRYNANE.—Harsh and ungenial month; vegetation very backward.

MONKSTOWN.—The middle of the month, just before Easter, was very cold. S 2 in. deep on morning of the 13th, and deeper in neighbouring districts.

BALLYSHANNON.—The rainfall has exceeded the corresponding period of last year by '80 in. S, sleet, and H fell on 10th and 11th. Bar. very variable, temp. low; little sign of growth yet. Cuckoo heard on 30th.

WARINGTOWN.—Cold, backward and variable.

EDENFEL, OMAGH.—With the exception of the first week, the month has been cold, raw and inclement, the second week especially so, with S, sleet and rain every day, and keen frost at night; as a result vegetation is backward beyond precedence. Hedges not yet (4th of May) in full leaf. Swallows appeared on the 9th, but disappeared again till the 25th; corncrake heard on 27th; and cuckoo on 29th.

A "SULPHUR" RAIN.

[Translated from the *Messenger du Midi*.]

A VERY remarkable phenomenon, and one calculated to excite the imagination of the peasantry, occurred during the recent rains near Castelnau and Lez. After the rain everybody noticed that the leaves of the trees and the sides of the roads were covered with a yellow dust, like powdered sulphur. What is usually known as a rain of sulphur had occurred.

This phenomenon, which is easily explained, is rare in our country, and is entirely due to the fall of the pollen of conifers after it has been carried by the wind.

LOAN COLLECTION OF SCIENTIFIC APPARATUS.

IN connection with the above fine collection, a series of Conferences are to be held in the Gallery at South Kensington. Those upon Physics and Astronomy on May 16th, 19th, and 24th, and those upon Physical Geography, Geology, Mineralogy, and Meteorology, on May 30th, June 1st, and June 2nd.

A certain number of Tickets for the use of the Fellows and their friends are in the hands of the Assistant-Secretary of the Meteorological Society, 30, Great George Street, S.W.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CXXV.]

JUNE, 1876.

[PRICE FOURPENCE,
or 5s. per ann post free.]

SCIENCE AT SOUTH KENSINGTON.

GENERAL.

THE above title, now so frequent in the daily papers, from *The Times* downwards, is a novelty, and universally regarded as such. Yet what a sham does this very fact of the novelty of Science at South Kensington prove the so-called Science and Art Department to have originally been. A fuss is being made about the cost of the loan exhibition of scientific apparatus, which, it is said, will be £25,000—but is that so very large a sum out of the Science and Art vote of £286,000? why, it is not one-tenth. Several other organisations having been grouped under the Science and Art Department, it is not easy to ascertain what the South Kensington establishment *alone* costs; but surely if the relative attention and funds devoted to each were known, it never would have been called the Science and Art Department, for even the “Art and Science Department” would have implied far greater attention to Science than it ever received. We hold that for years the title was utterly misleading, and we submit that the establishment ought to have been called the Art Department, for as far as practical work is concerned, Science at South Kensington was for many years *Vox et præterea nihil*.

At last, however, and for a reason upon which we need not dwell, a push has been made, a loan collection of scientific apparatus has been formed, and there have been conferences, demonstrations, &c., while we are told there is to be a scientific library established, costing thousands of pounds, and sundry other schemes are shadowed forth. To any ordinary mortal it would appear a farce to spend money in starting a rival to the British Museum Library, instead of appropriating it to the improvement (and as regards Science it sadly needs it) of that National Library, which South Kensington may cripple, but which even its great votes will never enable it to surpass.

However we are not politicians, and must simply take the goods the gods provide.

We, therefore, proceed to consider the meteorological portion of the loan exhibition.

The first essential of a collection of apparatus is a good catalogue, and this is notoriously absent. A bulky volume was indeed ready for the opening day, but on the cover it was stated to be "under revision," and truly it needed it. No revised edition has yet appeared, and the obviously wise plan of asking one expert in each branch, Astronomy, Physics, Meteorology, &c., to take absolute charge of his own portion of the catalogue, not having been adopted, we have no very high anticipations of the second edition, for there is no one person living who is competent to take entire charge. That the exhibitors are often themselves incompetent to describe that which they have sent is proved by a score of errors in the first edition evidently solely due to the contributors.

The exhibition is, however, open, the collection is undeniably a grand one, and there really are very many objects of high interest. We, therefore, purpose devoting considerable space to the subject, and to the best of our ability, not only describing, but also giving engravings of, the apparatus exhibited; the latter being, as most persons are aware, a very costly matter.

Here, however, we at once come upon a difficulty arising from the preponderance of the art element in the direction. Proprietors of artistic productions have ideas as to copyright, &c., very different from those entertained by the followers of science. Only a mind trained in an art school could have framed one of the conditions under which objects are exhibited at South Kensington, viz. :—

6. *Photographs, copies, or casts, are made of such loans as may be useful for instruction in Schools of Art, unless the lender objects in writing. Two copies of each photograph are sent to the lender. Permission to copy or photograph objects on loan is not granted to private persons without the sanction in writing of the lender.*

We have been obliged to meet this difficulty by issuing to all the Exhibitors in the Meteorological section the following circular :—

LOAN EXHIBITION OF SCIENTIFIC INSTRUMENTS, SOUTH KENSINGTON.

The Editor of the *Meteorological Magazine* presents his compliments to———, and will be much obliged if he will grant him permission to engrave, in the *Meteorological Magazine*, the apparatus which he exhibits at South Kensington.

The Editor will have the pleasure to forward a copy of the *Magazine* as soon as published.

Please address—

The Editor, *Meteorological Magazine*,
62, Camden Square,
London, N.W.

To those conversant with the scientific men of the present day it is almost needless to say that the consent has been immediately granted, and, moreover, that offers of the loan of engravings have been very

frequent. Still, there are several contributors residing at such distances that their replies cannot reach us in time for the present issue, and consequently we cannot make the following article quite so systematic and exhaustive as we should have done.

We desire also to record (and this seems the most appropriate place) our thanks to Major Festing, R.E., and the other officials in charge of the Exhibition, for the assistance which they have granted us in the present undertaking.

BAROMETERS.

ANTIQUE BAROMETERS.

Only one of the old barometers exhibited appears to have the date of manufacture marked upon it. There is in one of the Italian cases a double barometer (somewhat like fig. 1) bearing the inscription—

“Tubo di Torricelli,
Firenze, An. 1644.”

but we do not think that any person looking at the instrument, would credit its being two and a quarter centuries old. The cistern, a plain glass cylinder, is fixed, so are the tubes, and so is the scale; there is, therefore, no arrangement for correcting for variation of level of the mercury in the cistern. The one tube being merely hermetically sealed in the usual manner, and the other terminated with a bulb about $1\frac{3}{4}$ inch in diameter, intimates that the instrument was constructed to see if any difference of level resulted from the different area of vacuum above the column.

Two of Sir S. Moreland's Diagonal Barometers are exhibited, one [2807] in the simple form represented in many old works and in fig. 2, was made by Whitehurst, of Derby, and is exhibited by the Committee of the Royal Museum, Peel Park, Salford. We cannot in the least understand the graduations on this instrument; they are neither inches nor parts of an inch. The other [3026] is sent from the Hydrographic Office of the Admiralty, and consists of a frame about 30 in. broad by 42 in. high, and covered with a mass of printing, engravings, and moveable dials, showing besides atmospheric pressure, temperature, and the degree of humidity, (1) the moon's age, (2) its increase and decrease, and (3) how many hours and minutes it shines. Likewise (4) the times of high water at London Bridge. The opening on the middle table shows (5) the fixed feasts and remarkable days; the second opening shows (6) the sun's rising; the third (7) the sun's setting; the fourth (8) the day's length; the fifth (9) the break of day for every 15th day of the month; the sixth (10) the Zodiacal signs; the seventh (11) the sun's declination in degrees and minutes whether to the N. or S., and likewise (12) its place in degrees and minutes for every other day of each month. The eighth opening is (13) a table of equation of days in minutes and seconds for every other day of each month, which shows how much faster or slower a well-regulated clock or watch should be than a true sun-dial. The opening to the

right shows (14) the days of the month for every day in the week. The tables on the outside give (15) the date of Easter for 100 years in advance, from which all other movable feasts are easily found by reference to a table on the left (16). There is also at the right (17) a regal table giving the date in years, months and days when each king of England began to reign, also the length of his reign in years, months and days, and the place of his burial. The date of this curious instrument is about 1750, and it was made by Watkins and Smith, of London.

It may be well to mention that this diagonal form was adopted because as the atmospheric pressure balances vertical height, it is obvious that with an inclined tube an inch of vertical height becomes several inches in length. In the latter instrument each barometric inch is about seven inches long. This pattern has been abandoned, because the readings were vitiated by excessive repulsion and friction against the tube.

Pillischer, of Bond Street, exhibits a fine old Dutch Barometer, by Reballio [2797], combining a syphon and long range barometer, together with thermometer and hygrometer.

Dr. Henry de Saussure, of Geneva, sends a Mountain Barometer, by De Luc, which was used by H. Benedict de Saussure.

MERCURIAL STANDARDS.

The finest barometer is undoubtedly Casella's Observatory Standard (fig. 3), with a quarter of a hundredweight of mercury, a column of nearly an inch internal diameter, and a fixed cubical cistern. The alteration of the level of the mercury in the cistern is guarded against in the most perfect manner by making the scales adjustable, so that while the one end of each scale is adjusted to contact with the mercury, the other carries the graduation and the vernier. There are two scales, inches and millimetres, each, of course, with ivory point and vernier.

FORTIN'S BAROMETERS.

This construction is that most generally employed by the private observers of this country. The divisions are engraved on the brass tube which protects the instrument, the zero of the divisions being a fixed ivory point. The lower part of the cistern of barometers of this pattern being made of flexible leather, the capacity of the cistern can be so varied by turning the screw at its base, that the level of the mercury can at all times be brought to contact with the zero point.

Negretti and Zambra send two, one of them (fig. 4), is a very fine specimen, the best of the class. Others are exhibited by the Meteorological Society [2783], Adie [2790, 2791, 2792], Elliott [2806], and Pastorelli [2809].

KEW PATTERN BAROMETERS.

It is evident that if the area of the tube of a barometer be 0.1 inch, and that of the cistern 1 inch, a fall of the mercury of an inch would

raise the level of the cistern 0·1 inch. We have shown above that in Casella's barometer this is corrected for, by moving the scale until its lower extremity is in contact with the mercury; also that in the Fortin barometer the scale is fixed, and the mercury moved up (or down) to it. We have now to deal with another mode of neutralizing the difficulty. In the Kew pattern barometer the area of the cistern and of the tube are accurately determined, their ratio to each other computed, and the divisions of the scale so contracted that the true height corrected for the variable height of the mercury in the cistern is indicated. The inches on the scale are therefore not inches, but the representatives of inches.

The avoidance of the trouble of adjusting the ivory point to the mercury, or the mercury to the ivory point, has induced the very general employment of this form, and for marine purposes it is the best and most simple. It is also by far the best for unskilled or careless observers on land, but it seems too generally forgotten that while with a Fortin barometer the loss of a little mercury is of no consequence, with the Kew pattern the slightest leakage from the cistern is fatal; and the instrument is so screwed up by the makers that the observers have no means of knowing whether their barometer is in order or not, except by comparing it with others. We believe that this accident rarely occurs, but skilled observers like to be able to ascertain independently the accuracy of their observations. Instruments of this pattern are shown by the Meteorological Committee [2776], Pastorelli [2787 and 2808], and Adie [2794].

GUN BAROMETERS.

These only differ from the above in the tube being cased with India-rubber, to guard against concussion from the firing of heavy artillery. One (fig. 5), is exhibited by Negretti and Zambra, who originally designed, and made, them for, and with the assistance of, Admiral Fitzroy. The Meteorological Committee exhibit another of the same pattern made by Adie [2788].

MINING BAROMETERS.

Elliott Brothers send a Kew pattern Barometer, [3385] in wood, of the kind usually employed for mines, and Davis, of Derby, is reported to have sent another [3389b], but we have not seen it.

MOUNTAIN MERCURIAL BAROMETERS.

The Scottish Meteorological Society exhibit, along with the rest of their instruments, [2801] Mr. Stevenson's portable, but very rough and heavy Iron Barometer, as improved by Sang, in which the reading is obtained by a wooden float, resting on the short leg of the syphon (fig 6). The instrument is thus described* :—

“At a meeting of the Scottish Meteorological Society in April last, a letter from New South Wales was read, stating the impossibility of

* Journal of the *Scottish Meteorological Society*, Vol. 4, p. 265.

conveying barometers in safety to remote stations in that colony, and asking whether the Society could suggest some good form of portable instrument. I suggested for that purpose the employment of an iron barometer, and a Committee was appointed to consider the proposal; and I have since had one made of malleable iron tube. What appeared the best form was to have the upper working part of the barometer carefully turned, so as to be of strictly accurate form, and to have this part of larger diameter than that of the lower working tube, so as to enlarge the scale. On the lower or shorter bend of the iron tube there should be two stopcocks; the lower one being placed so as to confine, when the instrument was to be moved, the whole of the mercury, excepting, say, 1 inch of the column. By this arrangement, when the mercury is made to occupy the vacuum at the top of the long branch, and the lower stopcock is shut, no air can mix with the mercury; while by shutting the upper stopcock, the remaining inch of mercury is prevented from escaping, and the air that has mixed with it on the journey, will be allowed to escape before the instrument is used by opening the upper stopcock.

On showing the iron barometer to my friend Mr. Edward Sang, F.R.S.E., he suggested other two stopcocks and a plug-hole, an arrangement which seems to me admirably suited for iron barometers, and which he had originally thought of for glass tubes.

Mr. Sang thus describes his arrangement: "All the stopcocks being open, and the plug at D out, fill in mercury till it begin to escape at D; shut C, and fill to above A; shut A and B, put in the plug D, and open C. The float should then show the true reading as compared with a standard instrument. In this way a reading can always be obtained at the most inaccessible station, as accurate as when the instrument left the maker's hands.

"If air be suspected between the top of the mercury and B, shut C, open B (A remaining shut all the while); then the mercury in the space A B will descend to fill the tube, and the expanded air will rise to A. Shut B, take out the plug D, to allow any mercury to escape; open C, and see if there be any change in the reading: you may thereby know if there had been any air in the tube. To repeat the process of exhaustion, see that there be plenty of mercury above A, open A to allow the minute quantity of air to escape, shut A and proceed as before."

Water or oil barometers may be very cheaply and easily constructed if made of iron tube, and the scale may be readily enlarged by increasing the diameter of the upper working portion, so as to indicate still more clearly sudden changes in the atmospheric pressure.

Two Mountain Barometers, one on Fortin's plan [2795] (fig. 7) and one on Gay Lussac's plan [2796] are exhibited by Adie; a Kew pattern one by Pastorelli, and two old patterns are shown by Mr. Symons; one of which is represented in fig. 8.

Capt. George exhibits (in the Geographical Society's case) [3029] one of his Mountain Barometers, filled by the spiral cord method, whereby the barometer tube being carried empty is less liable to

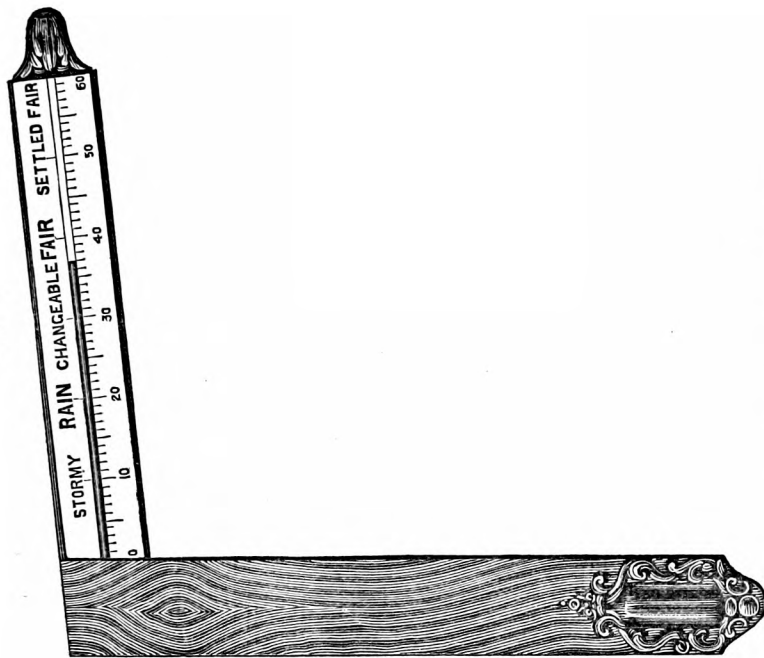
ANTIQUE BAROMETERS.

Fig 1.



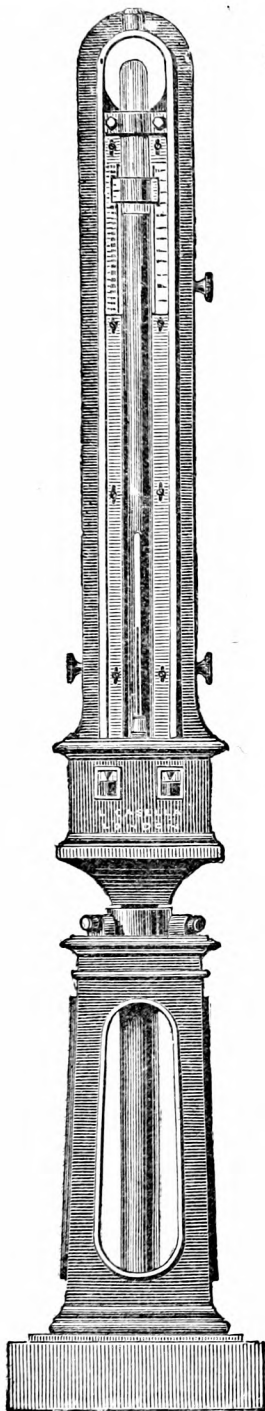
Torricelli.

Fig. 2.



Sir S. Moreland's Diagonal.

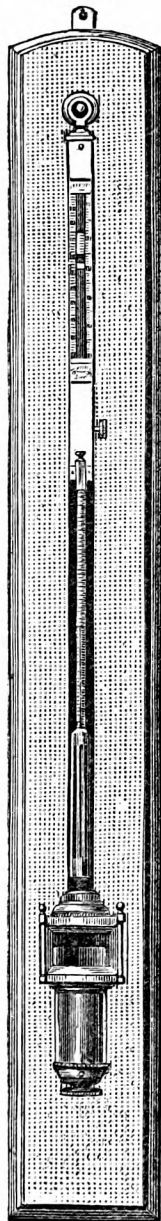
Fig. 3.



Casella's Observatory
Standard.

STANDARD BAROMETERS.

Fig. 4.



Fortin's
Standard.

Fig. 5.



Negretti's
Gun
Barometer

MOUNTAIN BAROMETERS.

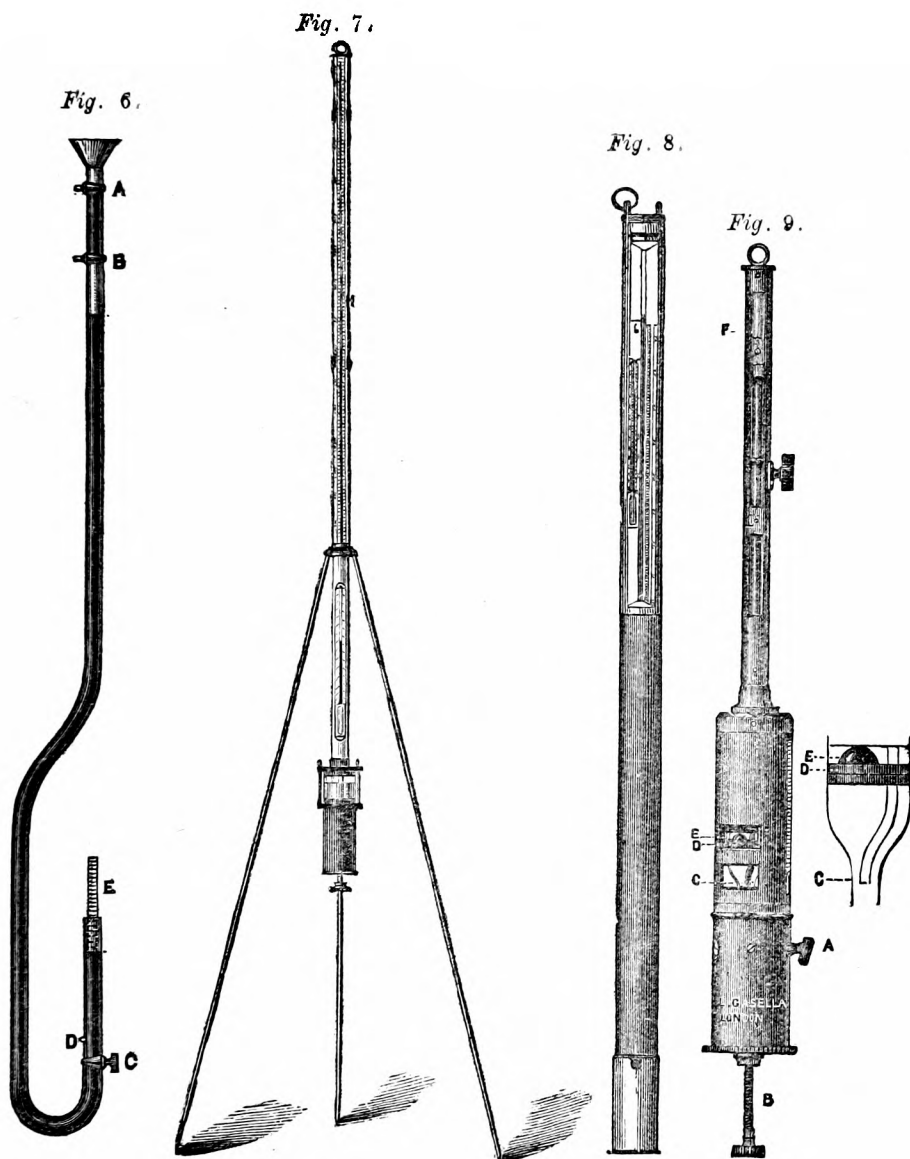


Fig. 6.—Stevenson's Iron Barometer.
Fig. 7.—Fortin's Mountain Barometer.
Fig. 8.—Old Mountain Barometer.
Fig. 9.—Casella's Mariotti Barometer.

ANEROID BAROMETERS.

Fig. 10.

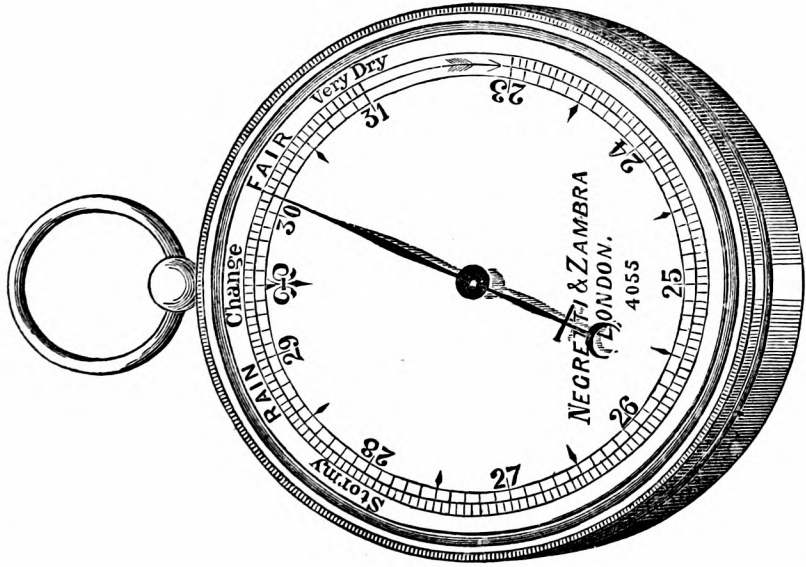


Fig. 11.

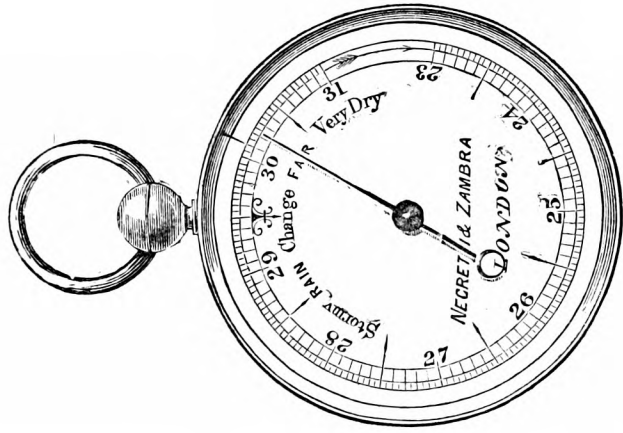
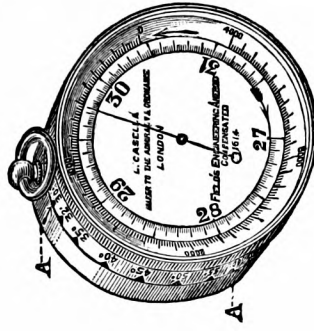


Fig. 12.



breakage; another will be found along with the mountain barometers.

Casella sends one of Macneill's Portable Mariotti Barometers [2809c] (fig. 9), which is thus described:—

"This instrument combines in itself the probability of the Aneroid and the constant correctness of the Standard Barometer. Its action depends on the well-known laws of Mariotti and Boyle, applied to the expansion and compression of air. It consists of a short centre glass tube, a lower open air tube or bulb, with diaphragm joined to it, with a vulcanite covering for insulation, and a brass tube, or shield, which covers the glass tube, and on which the graduations and figures are engraved. Attached to this is a cistern filled with mercury, which has a stopcock and a coarse screw adjustment.

"The total length is from 12 to 15 inches; but, for convenience of carriage, the cistern may be detached and carried separately.

"The weight and pressure of the atmosphere is determined accurately, at each observation, by an uniform volume of air being admitted and compressed by the advance of the mercury from the cistern to a fixed point, or zero, so that no accumulation of error is possible; and the reading will be equally accurate for all times and for all places.

"It is not necessary that the same quantity of mercury be always used, and it need not be boiled.

"The readings are taken from two points, as in the Fortin's Barometer.

"The scale reads to hundredths of an inch, by means of a vernier, and it is correct and independent of comparison with a Standard Barometer to the .02 of an inch; the corrections for reducing the reading to 32° are the same as in the Standard Barometer.

"The Pocket Barometer is equally accurate at the bottom of the deepest mine and at the top of the highest mountain, as well as at all temperatures, the error at these extremes being no greater than at two consecutive readings at the Sea Level; and thus, for great ranges, or isolated positions, as a standard of reference, this instrument has no equal, and it is in the fact that this really Portable Barometer needs no adjustment that its great merit lies; hence its value to travellers and residents in foreign countries, where a mercurial standard cannot be easily referred to."

ANEROID BAROMETERS.

Negretti and Zambra, as the first persons to reduce aneroids successively to diameters of 2.7 in. and 1.9 in., exhibit specimens of each, which are represented in their actual size in figures 10 and 11.

Pastorelli sends aneroids of various sizes from 9 in. diameter down to 1.9 in. Some of his, mounted like box chronometers, appear to be of high excellence, and are very handsome.

Another handsome form of aneroid is lent by Mr. Washington Moon, the speciality of which is that the spokes of the steering wheel (in a model of which the aneroid is set) turn the index hand.

Goldschmid, of Zurich, sends a variety of aneroids of his very sensitive form, also some on the Weilenmann system [2811—2815]. We cannot at present spare time or space to explain these methods, but

the essential principle is the very excellent one of giving the vacuum box as little work to do as possible.

Pillischer exhibits a bijou aneroid [2816], the dial being only five-eighths of an inch in diameter, and the outside case only $\frac{3}{4}$ of an inch ; it has jewelled bearings, and probably is, as the maker says, "the smallest instrument of the kind ever constructed."

An aneroid [2810] with jewelled bearings and magnifying reading lens, is exhibited by the Hon. Ralph Abercromby.

Casella sends a specimen of Field's engineering aneroid, fig. 12, 2 in. in diameter, and also a diagram showing the marvellous results obtained with it by Mr. W. H. Thomas, C.E. This is the only form of aneroid which has an altitude scale capable of adjustment for air temperature, and therefore of yielding accurate results corrected for the temperature of the air at the time of observation.

Deutschbein, of Hamburg, sends aneroids on the Reitz system [2817 and 2819] and on his own [2818].

Richard, of Paris, sends metallic barometers of extreme sensibility, one [2809b] 7.9 in. in diameter is said to be so delicate that 0.001 in. of pressure is represented by a motion of the hand through nearly half-an-inch—another [2809c] $5\frac{1}{2}$ in. in diameter, is said to give about half-an-inch for 0.010 of pressure.

Redier, of Paris, exhibits a barometer dial *five feet* in diameter, the hand of which is kept in its true position by a single ordinary aneroid vacuum box. This at first appears a paradox, for the mastery of a hand for a five feet dial requires considerable force. The solution of the mystery lies in the fact that the motive force is (as in Redier's barograph) a double train of clockwork, and all that the aneroid has to do is to allow one of these trains to work, or to prevent it so doing—the force for which can hardly exceed half-a-dozen grains.

(To be continued.)

FINE METEOR.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps a short account of a meteor which I observed on Saturday, May 20th, may be of interest.

At 1.42 a.m. I was walking along Oxford-road, Kilburn, facing N., when a sudden light, like a double flash of lightning, only rather more prolonged, lit up the road. On looking up, I saw a most brilliant meteor, or rather two, moving rapidly across the sky, one was following almost close on the other ; the first was about five times as bright as a star of the first magnitude, and had a bluish tinge ; the second was yellow, and not quite so bright. They were accompanied by a brilliant and clearly-defined tail, which did not remain any appreciable time after their disappearance.

The course of the meteors was perfectly straight from S.S.W. to N.N.E., and they disappeared about 60° above the horizon.

The sky was clear, and the night calm and rather cold.

I am, Sir, yours faithfully,

H. SOWERBY WALLIS.

1, Springfield Road, N.W., May 22nd, 1876.

MAY, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which 41 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.				
											inches	inches.	in.	
I.	Camden Town	·94	— 1·46	·43	22	6	71·1	30	32·8	5	0	5		
II.	Maidstone (Linton Park).....	·99	— 1·25	·44	24	6	78·0	30	30·0	2	7	...		
III.	Selborne (The Wakes).....	·63	— 1·85	·49	24	4	66·5	23†	29·5	5	7	8		
III.	Hitchen	·71	— 1·22	·18	22	10	65·0	21‡	28·0	1	10	...		
IV.	Banbury	·31	— 1·91	·11	24	6	70·0	30	29·5	2, 3	3	...		
IV.	Bury St. Edmunds (Culford).....	·70	— 1·46	·30	26	8	75·0	30	28·0	3	7	10		
V.	Norwich (Sprowston).....	·74	...	·18	22	12	...	...	...	...	...	...
"	Bridport	·29	— 1·74	·20	24	3	...	...	...	...	...	...
"	Barnstaple.....	·64	— 1·80	·34	23	5	70·0	7, 21	35·0	1	...	...
"	Bodmin	·29	— 2·17	·23	25	4	69·0	21	36·0	3	0	3		
VI.	Cirencester	·65	— 1·63	·34	23	4	...	...	...	...	...	...
"	Shifnal (Haughton Hall) ...	·74	— 1·52	·30	22	6	68·0	21	30·0	2, 3	4	13		
"	Tenbury (Orleton)	·67	— 2·21	·36	23	6	70·7	21	28·3	3	7	14		
VII.	Leicester (Belmont Villas) ...	·60	...	·20	24	6	71·0	21	29·8	3	1	...		
"	Boston	·84	— 1·10	·31	22	8	72·0	20	32·0	2, 3	2	...		
"	Grimsby (Killingholme)	1·24	...	·45	26	8	67·0	29‡	32·0	3	1	...		
"	Mansfield	1·02	...	·52	24	10	70·6	21	25·2	3	6	6		
VIII.	Manchester	1·08	— 1·58	·42	23	6	72·0	21	29·5	3	2	9		
IX.	York	·71	— 1·24	·36	22	7	66·0	28	30·0	2	2	...		
"	Skipton (Arncliffe)	1·02	— 2·33	·25	22	10	71·0	21	32·0	19	...	...
X.	North Shields	·99	— 1·65	·36	23	10	65·0	5	32·0	3	1	3		
"	Borrowdale (Seathwaite)	2·05	— 7·49	·80	22	7	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	·33	— 2·39	·12	27	5	64·2	11	30·0	2	3	15		
"	Machynlleth	·68	...	·21	22	5	74·0	6	27·0	1, 2	7	...		
"	Llandudno	·26	— 2·12	·11	21	6	...	...	...	...	...	...
XII.	Dumfries (Crichton Asylum)	·63	— 1·80	·37	23	5	68·0	7	29·5	2	4	5		
"	Hawick (Silverbut Hall)	1·11	...	·41	23	6	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill) .....	...	...	...	...	...	...	...	...	...	...	...
XV.	Castle Toward	1·09	— 2·30	·29	22	7	62·0	6, 11	30·0	3	1	...		
XVI.	Mull (Quinish)	·66	...	·14	26	7	...	...	...	...	...	...
"	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...
"	Grandtully	·63	...	·32	23	3	...	...	...	...	...	...
XVII.	Braemar	1·22	— ·58	·70	23	10	65·0	6	28·0	2	9	21		
"	Aberdeen	·61	...	·13	21*	10	72·7	28	33·1	3	0	7		
XVIII.	Loch Broom	2·16	...	·77	23	11	...	...	...	...	...	...
"	Portree	2·06	— 3·59	·51	28	12	...	...	...	...	...	...
"	Inverness (Culloden)	·70	— ·86	·33	24	11	63·4	9, 13	29·8	2	1	14		
XIX.	Helmsdale	1·40	...	·34	24	10	...	...	...	...	...	...
"	Sandwick	1·32	— ·94	·35	21	13	58·8	11	34·0	1	0	1		
XX.	Caherciveen Darrynane Abbey	·83	...	·28	21	7	...	...	...	...	...	...
"	Cork	·25	...	...	...	...	...	...	...	...	...	...
"	Waterford ...	·57	— 1·68	·36	22	5	69·0	31	34·0	3	0	...		
"	Killaloe	1·36	— 1·82	·53	22	5	75·0	20‡	26·0	3	5	...		
XXI.	Portarlington	·44	— 2·76	·21	24	8	66·0	20	30·5	2	2	...		
"	Monkstown, Dublin	·66	— 1·25	·25	23	5	...	...	...	...	...	...
XXII.	Galway	·85	...	·47	23	6	71·0	8	33·0	1	0	...		
"	Ballyshannon ..	·97	...	·48	22	6	...	...	...	...	...	...
XXIII.	Waringstown	·36	...	·16	23	4	70·0	20	26·5	1	3	11		
"	Edenfel (Omagh)	1·16	...	·52	21	8	65·0	6	26·0	1	6	...		

* And 24.

† 29.

‡ 30.

— Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON MAY.

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.—Very cold, with N. and N.E. winds for the first 19 days, with frost nearly every evening, but the wind changed from N. to S. on 20th, and the latter part of the month milder, but vegetation very late, and as a whole it may be pronounced a disastrous month. Bar. generally high, and very little rain.

SELBORNE.—Prevailing winds first 20 days N.E., without one day's change; remainder of the month S.W. or N.W. The driest May for many years; less rain by 1.60 in. than the average of 12 years. All crops greatly retarded by the drought and cold. Temp. 4 ft. above ground on 20th, 33°-0.

HITCHEN.—A very cold month, average temp. only 46°.

CULFORD.—A dry and very cold May; E. or N.E. winds from the 2nd to the 20th, and an entire absence of rain from the 2nd to the 22nd; it only rained on 8 days, and the amount is only .70 in. The mean temp. of the month was 50°-2; polar winds prevailed on 20 days.

SPROWSTON.—An unusually cold and dry month, .74 in., is about 1½ in. below the average. H and R on evening of the 12th. Slight TS at 4 p.m. on 23rd.

BODMIN.—Average temp. of month 58°-2; rainfall 2.39 in. below the average of 27 years.

SHIFNAL.—Willow wren first heard on 4th; swifts arrived on 6th, and flycatchers on 30th. An unusually dry, cold May, the driest since 1844, the nearest approach having been 1863, when .79 in. fell, and 1870, when the fall was .76 in. With the exception of .03 in. which fell on the 1st, there was not a drop of R till the 22nd, when a change of wind from N. and N.E. to S.W., brought a refreshing fall of .30 in., followed on 24th by .29 in.; this, however, was soon dried up again by a return of the wind to the N. and N.W., in which quarter it remained till the close of the month. Bar. remarkably high throughout; scarcely any high winds; frost on the ground on 13 nights, kept vegetation very backward.

ORLETON.—A very cold and dry month, with a steady N.E. wind, and frequent frosty mornings. No measurable R fell between the 3rd and 21st; the weather was generally bright and favourable for farming operations. After the 20th R fell each day till the 25th; the remainder of the month was dry and fine, with much sun. Distant T was heard on 24th. Mean temp. of month was 3° below the average, and lower than that of any May for the last 16 years, except that of May, 1869.

LEICESTER.—Very dry month; no R falling between 2nd and 22nd; cold E. winds during the first 20 days; nights remarkably cold; the temp. on grass being frequently below the freezing point; the mean. temp. for that period was only 46.8 in. T on 24th; H on 25th. Vegetation very backward.

BOSTON.—Temp. 3°-2 below the average. A bitterly cold E. wind blew without intermission from the 7th to the 20th, checking the growth of the grass and young wheat, and making vegetation very backward. May in flower about the 22nd.

GRIMSBY.—Month very dry and ungenial till the 22nd, when we had some welcome rains, followed by fine growing weather. I never heard so little song from the white throat, willow wren, and other warblers. The foliage of both ash and oak very backward, but the ash further behind the oak than usual, owing no doubt to the dry weather. Willow warbler arrived on 3rd; spotted fly catcher first seen on 10th. Apple in blossom on 4th. Distant T on 22nd, and T S at 4.30 p.m. on 23rd.

MANSFIELD.—The month opened dull and bleak, changing on the 3rd to very agreeable weather, but on the wind veering to E. on 7th, a succession of dry cold days followed, parching up vegetation, and playing sad havoc among the young fruit; the 14th showed signs of a change, but the wind soon got into its old quarter, and the dry bright days continued till the 20th, when the wind got to the S.W., and as the air was charged with electricity, a few days of un-

settled weather followed ; the month, however, ending in fine genial seasonable weather. First swallow seen on 4th. T and L on 22nd. R, H, T and L at 3.15 p.m. on 24th.

ARNCLIFFE.—The smallest record of R I have ever made in May.

WALES.

HAVERFORDWEST.—One of the coldest and most ungenial May months on my record of 26 years ; on 18 nights the temp. below 40° ; scarcely any R or dew ; air extremely dry and harsh ; vegetation consequently suffering considerably. Easterly and northerly winds prevailed throughout the month. Driest May since 1859, when no R fell. Sky generally clear and bright throughout the month.

MACHYNLLETH.—A very cold month ; wind in the E. or N.E. to the 20th, then changed to the W., and a little warmer. Ther. fell very nearly to the freezing point on many nights ; this has been the driest month we have had since I began observing in 1869. T about 3 p.m. on 24th ; T and L about 10 p.m. on 30th.

LLANDUDNO.—A very dry month ; no R up to the 20th, and from then only .24 in. Polar winds prevailed up to the 19th, but their keenness tempered by ample sunshine ; only one night's frost. Grass suffering much from the drought. Broom in bloom on 2nd ; lilac on 5th ; hawthorn on 8th ; laburnum on 12th ; honeysuckle on 16th ; mountain ash on 24th.

SCOTLAND.

DUMFRIES.—A very cold month ; rainfall unprecedentedly small, and temp. 3° below that of last year. Winds chiefly E. from 6th to 20th.

HAWICK.—The first 8 days sunshiny, but keen frosty nights ; 9th and 10th were very damaging to all kinds of crops from the strong arid E. winds. Very keen frosts on the nights of 11th and 12th. Ther. registering 6° (?) on both nights. Fine genial R on 22nd, followed by heavy T showers on 23rd. The month has not been favourable for the growth of anything, and everything is late this season. A fine appearance of blossom of apples and pears, which coming late, escaped the frost.

CASTLE TOWARD.—No R measureable till the 22nd, and the total fall of the month (1.09 in.) very much below the average. It has been a favourable month for all kinds of out-door work, and seeds being got into the ground in good order. Pastures look well since the R, of which they were previously in great need ; the strong E. winds have parched everything.

BRAEMAR.—First half of the month very dry ; vegetation in consequence fully three weeks later than usual.

ABERDEEN.—A very dry month ; R scarce one-third of the average ; bar. much above the average, and the temp. about $1\frac{1}{2}^{\circ}$ above the average ; winds light, but too often from N., N.W. and N.E. ; crops very far behind.

LOCHBROOM.—This has been a remarkably dry month, at times quite hot, at others cold ; with the exception of a slight shower on 15th, we had no R till the 20th, after which copious rains fell on three or four days, and more or less on every day till the 30th, except on the 27th. The farmers grumbled, but the fine weather was very favourable for the lambing season, though the feed for the stock generally was reduced thereby.

PORTREE.—The first 18 days of the month were quite rainless, with cold, sharp easterly winds and frosts at night ; after the 18th R every day (except the 24th), and the weather still cold. Total fall, 2.06 in., is exactly the same as that of 1871.

CULLODEN.—A storm of H in forenoon of the 1st, and a slight shower on the 15th, but no other fall till the 22nd ; total fall about half the average. E. winds very prevalent ; corn crops and pasture suffering for want of moisture.

SANDWICK.—May has been a pleasant month ; till the 21st it was very dry, and the soil became parched, but after that time there was moisture in some form almost every day to moisten the soil and refresh the vegetation.

IRELAND.

DARRYNANE.—An unusually dry month, total '83 in. I never registered less than 1'20 in. in any month before, and that was May, 1874. In the early part rather sharp E. winds, the latter part much milder, with variable winds. A gale from N.W. on 22nd and 23rd; H with T on 24th; no R till the 20th, after which to 25th R daily. Potato crop looking well, but great complaints of a scarcity of grass for want of R. Sea very calm all the month.

KILLALOE.—A very late month; much blight from the frost in the first five nights; no R till the 22nd. Flowering plants whether in garden or field fully three weeks late. The hardy blackthorn more than a month late.

MONKSTOWN.—The first three weeks unusually dry and bright, with cold E. winds; R on 21st, 22nd, and 23rd. The latter part of the month bright and warm.

BALLYSHANNON.—The month has been unusually dry ('97 in.), but little more than half the quantity that fell in the corresponding period of 1875. No R till the 21st, except '01 in. on the 15th. Grass has suffered severely in consequence, and crops in general are backward; hawthorn only now coming into bloom. Salmon fishing, owing to drought, is not so good as in former years.

WARINGSTOWN.—Very dry; no R till 21st, and only '36 in. in the month.

EDENFEL, OMAGH.—Weather up to 20th dry and parching, with strong sun by day, and cold, sometimes frosty, nights (no R to 21st, except '01 on 14th); remainder of the month broken, rainy, and deficient in warmth. Vegetation still backward.

SUPPLEMENTARY TABLE OF RAINFALL IN MAY, 1876.

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

Station.	Total Rain. in.	Station.	Total Rain. in.
Acol	1'23	Llanfrechfa	'42
Hailsham	'90	Castle Malgwyn	'29
Andover	'23	Heyope	2'8
Strathfield Turgiss	'29	Rhug, Corwen	'88
Addington Manor	'63	Port Madoc	'68
Oxford	'75	Melrose	'96
Cambridge	'46	Cessnock, Glasgow	'81
Sheering	'76	Gruinart	'97
Ipswich	'92	Keith	1'34
Diss	'77	Strathconan	1'78
Swaffham	1'24	Springfield, Tain	'77
Compton Bassett	'61	Skibbereen	2'7
Dartmoor	'45	Glenville, Fermoy	'39
Teignmouth	'65	Tralee	1'11
Torrington (Langtree) ..	'20	Newcastle W., Limerick ..	1'14
Trevarrick, St. Austell ..	'24	Kilkenny	'61
Taunton	'18	Kilsallaghan	1'50
Sansaw	'57	Twyford, Athlone	'58
Cheadle	1'41	Ballinasloe	'67
Ashby-de-la-Zouch	'70	Kylemore	2'10
Coston, Melton Mowbray ..	'72	Bangor	2'11
Bucknall	'78	Carrick on Shannon	'61
Walton, Liverpool	'56	Rockcorry	'59
Broughton-in-Furness ..	'51	Warrenpoint	'42
Stanley, Wakefield	'68	Bushmills	'57
Gainford	69'2	Buncrana	'69
Shap	'86		

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CXXVI.]

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SCIENCE AT SOUTH KENSINGTON.

(Continued from page 72).

At the present date (July 11th) it is still impossible to obtain a catalogue of any kind whatever. The first edition, in spite of all its faults, was exhausted a few days after the opening; weeks have come and gone, but the second edition has not appeared in public. Meanwhile, the London season has nearly run its course, and such persons as have visited the collection, have wandered through it without a guide, either good, bad, or indifferent. We shall not give currency to any rumours respecting this second edition, but proceed to a far more important matter.

The name of the British Government was freely used in order to obtain a collection of apparatus; passing all such trivial matters as seem to have nearly swamped South Kensington, we come to the question, whether there is or is not to be an Official Catalogue worthy of the Exhibition, of the Nation, and of Science? If it has been wise to spend what has gone beyond recall, it is surely desirable to turn the collection to the best account, to do something more than continue an extra lounge for a few thousand natives and foreigners, and to prepare such a catalogue as we have indicated.

If the authorities do not bestir themselves, it may finally result that the only approach to a detailed and systematic notice will be that in these pages. Surely when printing costs them nothing, they who can have hundreds or thousands of pounds for asking, will not fold their arms, and say that it is too much trouble.

MACNEILL'S MARIOTTI BAROMETER.

The Rev. J. M. Du Port has called our attention to the fact that the description of this instrument on p. 71 of our last number is incomplete. These articles seem likely to be so long that we suppressed the following paragraphs; we, however, admit that they are essential, are glad that the error was pointed out, and insert them. Of course, the letters refer to the engraving in our last.

INSTRUCTIONS.—The Barometer should be suspended in the shade, in a good light, and time should be given for the instrument to take the temperature of the place before making an observation; and two readings should not be taken within

a less interval than ten minutes, so as to allow any heat generated in the first observation to escape before taking another.

The instrument should not be handled immediately before taking an observation, nor should the observer approach it from a fire, or with hands and clothes of a temperature differing materially from that of the instrument, otherwise the volume of air just admitted might be to some extent affected, notwithstanding the insulated covering of the air chamber.

When the instrument is hung up for observation, the stopcock *A* should be opened, and the mercury raised by the screw *B*, until it nearly touches the bottom of the tube *C*, as seen through the lower slit or opening in the ebonite body. After an interval of a few minutes the instrument is ready for an observation, and the mercury should then be quietly raised until it closes the bottom of the tube *C*, after which the screw *B* may be turned more rapidly, until the mercury appears through the diaphragm *D* in the form of a drop at *E*, which drop or convex surface must be raised so as barely to intercept the light, and form a tangent to the top opening, just, or barely, excluding the light (as in a Standard Barometer), by keeping the eye in the same plane with the back and front lower edges, which is the zero of the instrument.

The stopcock *A* is then to be turned off and the vernier set, so that its lower edge shall exactly form a tangent to the convex surface of the mercury in the tube *F*, just excluding the light whilst keeping the eye in the same plane with the lower back and front edges of the vernier (the time occupied should be about one minute from the closing of the tube *C* until the vernier is set); after which the reading may be noted at leisure, and the usual corrections for temperature and index error made as in the Standard Barometer, the same tables being alike applicable to both. No other corrections are necessary in the Mariotti Barometer.

The stopcock *A* should be then opened and the mercury allowed to descend to a little below the bottom of the tube *C*. The instrument will then be ready for the next reading.

The glass tube *C F* being open at the top, the instrument should not be laid down on its side until all the mercury is lowered into the cistern and the stopcock *A* closed, when it may be placed in any position.

ANTIQUE BAROMETERS.

We believe that the only antique barometers not described last month are—[2809 *a1*] "First barometer, with weights, by Conté. Used in the Expedition of Egypt;" and [2809 *a2*] "Barometer, with overfall, constructed by Megnié, for Delavoisier." We simply record their presence, because we do not understand that by Conté, and that by Megnié, though very interesting on account of its age and the associations connected with its previous owner, is not otherwise of importance; both these instruments have been lent by the Director of the Conservatoire des Arts et Métiers, Paris.

MISCELLANEOUS MERCURIAL BAROMETERS.

A standard barometer, with electrical adjustment, is exhibited by Negretti and Zambra, who thus describe its construction and use:—

"This barometer consists of an upright glass tube dipping into a glass cistern of mercury, so contrived, that an up-and-down movement, by means of a screw, can be imparted to it. Through the top of the tube a piece of platina wire is passed and hermetically sealed. The cistern also has a metallic connection, so that by means of covered copper wires (in the back of the frame) a galvanic circuit is established;

another connection also exists by means of a metallic point dipping into the cistern. The circuit, however, can be cut off from this by means of a switch placed about midway up the frame. On one side of the tube is placed a scale of inches; with a small circular vernier, divided into 100 parts, connected with the dipping point, and working at right angles with this scale.

"For taking an observation, a galvanic battery is connected by two binding screws at the bottom of the frame. The switch is turned upwards, thereby disconnecting the dipping point; the cistern is then screwed up, so that the mercury in the tube is brought into contact with the platina wire at the top; the instant this is effected a *magnetic needle* arranged as a galvanometer on the barometer board will be deflected. The switch is now turned down; by so doing the connection with the upper wire or platina is cut off, and established between the dipping point carrying the circular vernier and the bottom of the cistern; the point is now screwed by means of the milled head until the *needle* is again deflected, and the line on the vernier cutting the division on the scale is the exact reading of the barometer."

Howson's Patent Long Range Barometer (fig. 13) is exhibited by Negretti and Zambra. This is the best of the open scale barometers, and very well adapted for the halls of large houses, clubs, &c., but it is not an instrument of scientific precision.

"In this instrument the tube is fixed, but its cistern is movable and sustained by the upward pressure of the atmosphere. The diameter of the tube is about an inch. A long glass rod is fixed to the bottom of the glass cistern, where a piece of cork or some elastic substance is also placed. The tube is filled with mercury; the glass rod is plunged into the tube as it is held top downwards, until the cork gets close up to the tube and fits tightly against it. The pressure against the cork simply prevents the mercury from coming out while the instrument is being inverted. When it is inverted, the mercury partly falls and forms an ordinary barometric column. When the top is held, the cistern and glass rod, instead of falling away, remain suspended. The glass rod, being so much lighter than mercury, floats and sustains the additional weight of the cistern by its buoyancy, and the atmosphere acting upon the mercury, keeps up the barometric column. Supposing there is a rise in the barometer, the atmosphere presses more mercury up the tube. This mercury is taken out of the cistern, which of course becomes lighter, and therefore the rod and cistern float up a little higher, which thus causes the column of mercury to rise still more. The increased pressure and buoyancy thus acting together, increase the ascent in the barometric column, as shown by the fixed scale. Supposing there were a decrease of pressure, the mercury would fall, come into the cistern, make it heavier, and increase the fall. Fig. 13 shows the appearance of the instrument as mounted in an ornamental carved oak case. Readings may be taken by this Barometer to three places of decimals without a vernier."

Prof. Bohn, of Aschaffenburg, sends a mercurial barometer [2802], which, it is said, "can be rendered entirely void of air in half-an-hour without boiling." It is, however, adapted only for laboratory use, as will be at once evident on reference to its representation on fig. 14, and from our mentioning that with the exception of an iron supporting rod, the instrument is wholly of glass, even the divisions being etched on the tube. The following is Prof. Bohn's description :—

A barometer to be made easily and in short time, without boiling of the mercury, perfectly empty of air.

Pour some mercury very dry, and heated to nearly 100° C, by C, with a funnel in its tube, whilst the stopcock B is closed, A open, until some mercury issues at A.

Close stop A and open B, mercury will issue.

Wait for five minutes, in order that the air absorbed by the mercury, and adhering to the glass, has time to disengage in the barometrical chamber.

Close B, let A be closed also, and pour some mercury by C, filling quite the tube. Open stop A, and let issue any drops. Afterwards close A, open B, mercury issues ; wait for two minutes, close B.

Repeat the operations in the said order five or six times more. When for the last time mercury stands near C, and A is closed, varnish over the stopcock with a solution of collodium, in order to render the closure better ; open then B as long as mercury reaches at X.

The difference of the lectures on the division at X and at Y is the height of the barometer.

If the vacuity in the barometrical chamber is a perfect one, the difference of the two mercurial columns will remain the same when any more mercury is filled in or let out.

Prof. Kruezer exhibits a Compensated Barometer (fig. 15), [2805] of which the following explanation is given :—

"The upper part of the tube is enlarged to a retort, the volume of which corresponds to a length of one or two metres of the tube. A quantity of air is introduced into the tube, the pressure of which is equal to about 34·5^{mm.} mercury. The scale is divided with due regard to the effect of that depression, the zero having been adjusted by comparison with a standard barometer, the reading will immediately give the barometer height reduced to normal temperature of mercury and 1^{mm.}

scale. One millimetre of the scale = $\frac{P+p}{p} + \frac{345}{\lambda}$, p being the area of

the tube, P of the cistern, and $p \cdot \lambda$ the volume of the upper part above 725·5^{mm.} from the level in the cistern."

An instrument of this construction has been in use for some years at the Helsingfors Observatory.

A is the metal cover of the "retort" or enlarged upper part of the barometer tube ; a is the frame carrying the vernier ; B is the rack

for adjusting the lower end of the scale at c to the surface of the mercury in d.

From this it appears that in this instrument air has been purposely introduced to the top of the barometric column, and its expansion is employed to correct for the variation (1) in the specific gravity of the mercurial column, and (2) in the length of the measuring scale, produced by the alterations of temperature to which the instrument is subjected. The above variations act in the same direction, for increase of heat expands the mercury, renders it of less specific gravity, and, therefore, lengthens the column; but the same rise in temperature lengthens the brass scale by which the length of the column is measured. The inventor appears to have computed the volume of air of which the expansion would neutralize this joint action; but it seems to us that this expansion can only be correct for some one pressure. Moreover, as it is impracticable to test by the usual vacuum tap, there is no possibility of ascertaining if any other air has gained access to the top—in fact, it is impossible to ascertain whether the instrument is right or wrong except by comparing it with another.

The Meteorological Committee exhibit one of the barometers by Tonnelot, of Paris, which have closed cisterns like the Kew pattern, but the scale is not contracted, and therefore every reading has to be corrected for the varying level of the mercury in the cistern. This form of instrument is becoming generally used in France, and though we think it inferior both to the Kew pattern and to Fortin's, it is undoubtedly a good instrument, and is not costly.

The Deutsche Seewarte were to send [2803] one of Köppen's improved Kupfer's Barometers, with moveable bottom, constructed by Fuess, of Berlin, but we have not yet found it.

M. Gloukhoff, of St. Petersburg, exhibits a new form of barometer [2800a], by Brauer, of Pulkowa, (fig. 16) in which the principal novelty appears to be the forcing of the mercury at each observation into an entirely open cylinder. The scale, like those of Newman's Fortin barometers (now made by Negretti), and of Casella's Observatory Standard, is movable, and its lower end is brought into contact with the mercury in the cistern at each observation. This arrangement is probably cheaper than the Fortin, but it seems to us that the mercury must soon become very foul, both by oxidation and by collecting dust.

Hicks exhibits a new pattern of the old Hermetic Barometer (fig. 17). It essentially consists of two mercurial thermometers, an ordinary one to give the temperature of the instrument, and one with a very long scale and a flat circular bulb of 1.4 inch diameter; the sides of the latter will evidently be pressed together by increase of atmospheric pressure, and thus answer roughly as an indicator thereof; the change in the volume of the mercury due to temperature is provided for by a sliding scale, exactly as in sympiesometers. Mr. Hicks probably ex-

hibits this rather as a specimen of workmanship, and a novelty, than upon any idea that it is adapted for mountain work.

Wild's adjustable syphon barometer is shown by the Meteorological Committee [2784], and also [2800] by the Geneva Association for constructing Scientific Instruments. As, however, our engraving of it is not ready, and the instrument is one extensively used, we defer its description for a month.

SELF-RECORDING BAROMETERS—MERCURIAL.

The series of these instruments very good. The earliest is Kreil's Barograph [2891], exhibited by the Kew Committee; it consists of a syphon barometer with ivory float on the short leg, with a cord passing upwards and round a sector at one end of a horizontal lever; the other end of this lever carries a pencil. Behind the pencil is an oblong frame containing a sheet of paper, and this frame is drawn laterally by clockwork. At the other end of the apparatus is a clock which (1) draws the above-mentioned frame along horizontal rods, and (2) causes a hammer to strike the pencil every five minutes, and thus produces a series of dots upon the paper, higher or lower according to the height of the mercury in the barometer tube.

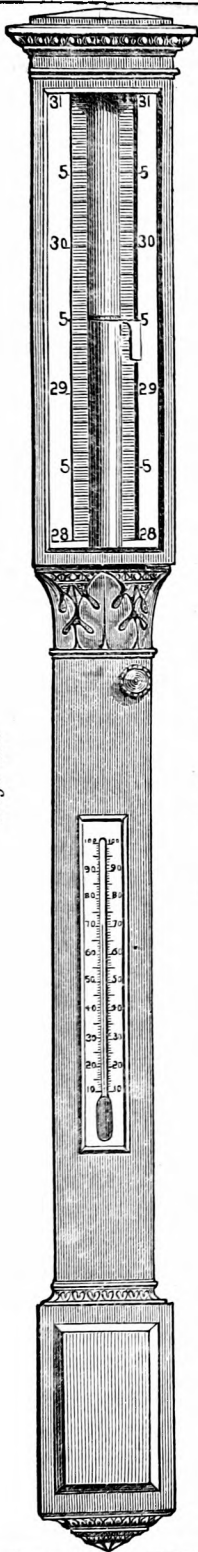
Milne's Barograph, exhibited by the Meteorological Committee, is similar to Kreil's in all essential parts, but is much more compact and handy.

Negretti's Improved Milne's Barograph carries this system of registration as near to perfection as is possible. The general principle is represented in fig. 18, but the specimen exhibited is more handsome than the engraving. The barometer tube remains as in Kreil's instrument, and also the float A, the chain from it, and half of the lever; but instead of the pencil being attached to the other end of the lever it will be seen that there is another arc, and a chain from it to the indicator B. Hence it is evident that the up and down motion of A is necessarily followed by a similar but reversed motion of B. As the mercury in A falls when the barometer rises, it follows that the indicator B rises when the barometric pressure increases, and falls when it falls. The indicator B, therefore, shows upon the scale C the reading of the barometer at any given instant. The chief objections to Kreil's and the ordinary Milne's barographs are (1) the friction of drawing the recording frame horizontally, (2) the fact that the pencil traverses an arc, and thus the time scale is necessarily curved. These objections are both removed by Negretti's arrangement, (1) by substituting a rotating cylinder for the traversing frame, and (2) by the second arc on the lever. The indicator B is driven against the paper-covered cylinder by the hammer of the clock below.

Redier's Barograph has been so recently (*Met. Mag.*, April, 1875) engraved and fully described in these pages, that we need only here report the exhibition of a specimen, and our regret that it has not been provided with recording sheets, and kept in operation.

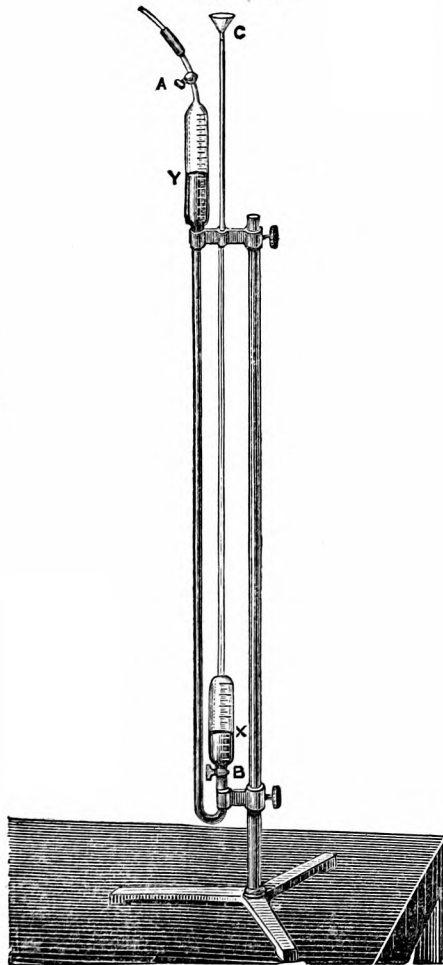
MISCELLANEOUS BAROMETERS.

Fig. 13.



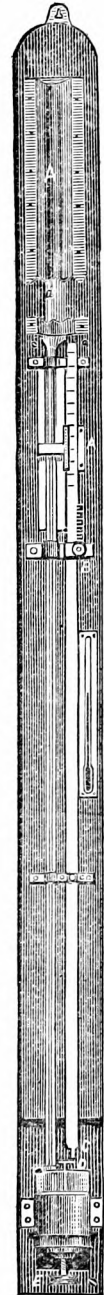
Howson's Long Range.

Fig. 14.



Bohn's.

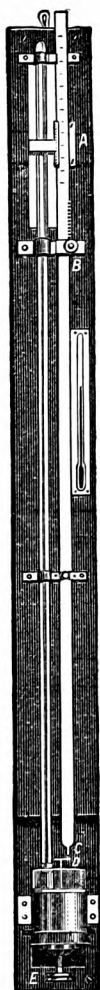
Fig. 15.



Kruezer's.

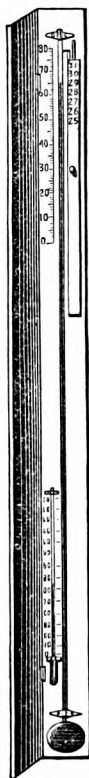
MISCELLANEOUS AND RECORDING BAROMETERS.

Fig. 16.



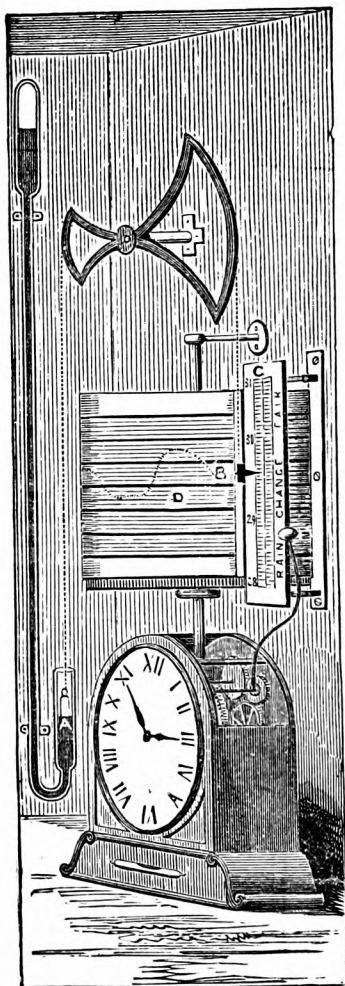
Gloukhoff's.

Fig. 17.



Hicks's Hermetic.

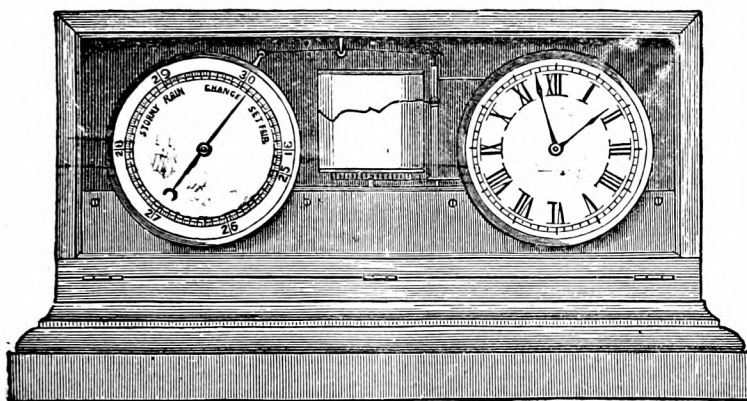
Fig. 18.



Negretti's Improved Milne.

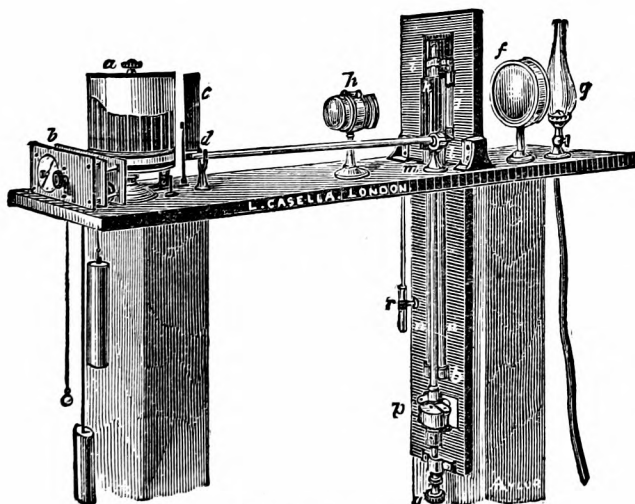
RECORDING BAROMETERS.

Fig. 19.



Recording Aneroid.

Fig. 20.



Kew Barograph.

SELF-RECORDING ANEROIDS.

Although *prima facie* it is evidently undesirable to give an aneroid box any work to do, the use of aneroids as self-recording instruments has steadily extended since their first introduction, about ten years ago. We do not think that even the delicate forms of Breguet [2892] or Pauger [2873] can equal the photographic mercurial barographs, or the clever non-photographic barograph of Redier; but they go near it, and are excellently adapted for use at sea. Pillischer sends a large and well-arranged instrument, suitable for a club or other large entrance hall. Pastorelli sends a smaller one [2885] (fig. 19) adapted for a library or other mantelpiece, and a similar one is sent by Elliott Brothers.

PHOTOGRAPHIC RECORDING BAROMETERS.

In the next place we have barographs recording by means of photography. The two patterns principally employed are represented by early specimens if not actually by the first of each species which was made. We are not sure as to the priority of Mr. Ronalds or Mr. Brooke; the catalogue states that Mr. Ronalds's instrument [2892] was constructed in 1847, the Greenwich volume states that Mr. Brooke's was brought into operation in 1848, for the present we, therefore, take the Ronalds' Barograph first.

Just as the improved form of Kreil's Barograph received, and passes by, the name of Admiral Milne's Barograph, Ronalds' Barograph is now often called the Beckley Barograph, or the Kew Barograph. Indeed the name of the original inventor has been so dropped, that there are probably not six of our readers who before the exhibition was opened knew that the barograph adopted by the Meteorological Committee was in all its essential features that of Ronalds. So much is this the case that we only give an engraving of the Beckley Barograph, fig. 20, and after describing it we will return to the Ronalds instrument, and show wherein it has been improved upon.

g is the source of light, f is a lens focussing the light upon the upper part of the barometer tube k , h is another lens throwing an image of the barometer tube on the drum a , which is covered with sensitized paper, and is rotated by the clock b . The clock, in addition to driving the drum a , is so arranged as to interpose the shutter c d , between a and h , once each hour, this prevents the light reaching the drum, and thus causes white lines, which act as the time scale when the paper is removed from the drum. It is evident that the height of the barometric column is thus continuously photographed on the rotating drum. The arrangement is further improved by the barometric tube being so fixed by zinc bars that the photographic record needs no correction for the temperature of the instrument. Now we return to Ronalds's original instrument, and as far as we can see, its only inferiority was that incidental to the condition of photographic knowledge at the time. His apparatus has not the luxurious finish which modern opticians pay so much attention to, and he adopted a flat daguerreotype plate, which was driven past the image by clockwork.

Brooke's Barograph has been in use at Greenwich for more than a quarter of a century, and that fact alone proves its value. Mr. Brooke from the first, used the revolving paper-covered drum, and the only questionable part of his arrangement is that he does not directly photograph the mercurial column, but uses a syphon barometer, with a float (like Kreil's), and allows the light to pass through a slit, in a plate of mica, carried by the arm. This, of course, introduces the question of friction which may or may not be worth consideration. We presume that the Astronomer Royal has long since satisfied himself that it is unimportant.

(*To be continued.*)

THUNDERSTORM NEAR LIVERPOOL.

To the Editor of the Meteorological Magazine.

SIR,—A severe thunderstorm passed over this place yesterday afternoon, shortly after 4 p.m. The previous day, Tuesday the 20th, was very hot, shade heat reaching $83^{\circ}0$. Yesterday, however, was still warmer, the shade maximum being $85^{\circ}5$, the highest reading of the thermometer since the 22nd July, 1873. About 3.15 p.m. a sudden change occurred, a strong and cold wind setting in from N.W. In one hour, that is to say, from exactly 3 p.m. to 4 p.m., the thermometer fell 15° , and from 3 p.m. to 7 p.m. the change amounted to exactly 30° , a most remarkable variation. Heavy rain fell during the storm, 1.03 inches being registered in 2 hours and 10 minutes. During the storm the upper current of cloud moved slowly from S.S.E. to N.N.W. The lightning was very vivid, and the thunder exceedingly loud.—Yours truly,

ARTHUR R. ANDERSSON.

Walton-on-the-Hill, near Liverpool, 22nd June, 1876.

HEAVY RAIN AT BRIGHTON.

To the Editor of the Meteorological Magazine.

SIR,—I send a few particulars as to the rain on June 22nd. Rain began at 8, and fell heavily after 8.30.

			Fall.				Fall.
June 22.	8	to 9.37 p.m.	... 0.270	10	to 10.30 p.m.	... 0.430	
	9.37	to 9.47	„ ... 0.170		10.30	to 11	„ ... 0.360
	9.47	to 9.52	„ ... 0.040		11	to 9 a.m. June 23	0.645
	9.52	to 9.55	„ ... 0.015				
	9.55	to 10	„ ... 0.060				1.990

No measurable quantity after 8 a.m.

Total greatest ever recorded in Brighton.

Dr. Taaffe, on the Steine, had 1.87 inches; "Revilo," Richmond Terrace, 2.15 inches; Brighton College, Eastern Road, Brighton, 1.95 inches; The Dyke, 2.15 inches; Fulking, 1.86 inches.—Yours very truly,

FREDERICK E. SAWYER.

55, Buckingham Place, Brighton, 6th July, 1876.

[At Worthing the fall was only 0.89 in.—Ed.]

JUNE, 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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Deg.	Date.		Deg.	Date.				
				Dpth	Date.									
											inches	inches.	in.	
I.	Camden Town	1.27	— 1.78	.44	15	11	84.8	21	39.4	11	0	0		
II.	Maidstone (Linton Park)	.98	— 1.76	.42	9	9	91.0	21	46.0	1	0	...		
III.	Selborne (The Wakes)	2.10	— 1.13	.68	15	12	83.0	21	36.5	11	0	0		
IV.	Hitchin	1.22	— 1.42	.51	15	12	75.0	20*	36.0	10	0	...		
V.	Banbury	2.17	— 1.11	.39	22	13	83.0	21	37.0	11	0	...		
VI.	Bury St. Edmunds (Culford)	2.75	+ .17	.70	15	12	80.0	12*	31.0	10	1	2		
VII.	Norwich (Sprowston)	1.80	...	.43	16	13	...	...	...	...	...	...
VIII.	Bridport	2.81	— .43	1.72	15	8	82.0	20	36.0	11	...	...
IX.	Barnstaple	1.25	— 2.87	.31	8	12	84.0	27†	46.0	22	0	...		
X.	Bodmin	1.75	— 2.29	.38	14	15	76.0	20†	41.0	22	0	0		
XI.	Cirencester	1.46	— 1.92	.49	15	10	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	2.52	— .59	.61	22	16	81.0	21	38.0	1	0	...		
XIII.	Tenbury (Orleton)	1.35	— 2.17	.30	15	12	84.2	21	35.2	11	0	1		
XIV.	Leicester (Belmont Villas)	1.91	...	.65	13	13	87.5	21	37.8	11	0	...
XV.	Boston	3.13	+ .94	1.43	23	13	82.0	20	42.0	4	0	0		
XVI.	Grimsby (Killingholme)	1.97	...	.59	13	13	70.0	12	39.0	11	0	...
XVII.	Mansfield	2.55	...	1.19	23	13	84.4	21	35.5	11	0	0		
XVIII.	Manchester	3.15	— .19	1.02	23	14	86.0	26	40.0	1,11	0	0		
XIX.	York	...	...	...	...	...	...	...	...	...	...	...
XX.	Skipton (Arncliffe)	3.46	— .64	.62	23	16	84.0	27	34.0	10	0	...		
XXI.	North Shields	2.03	— .71	.73	21	14	72.0	11	41.8	11	0	0		
XXII.	Borrowdale (Seathwaite)	8.34	— 2.17	2.32	5	11	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	1.97	— 1.68	.70	14	8	79.5	20	36.0	4	0	1		
XXV.	Machynlleth	2.28	...	.73	3	9	86.5	21	35.0	9	0	0
XXVI.	Llandudno	2.16	— .13	.68	21	12	86.0	20*	42.4	1	0	...		
XXVII.	Dumfries (Crichton Asylum)	3.11	— .28	.69	4	11	80.5	21	38.0	1	0	0		
XXVIII.	Hawick (Silverbut Hall)	2.99	...	.58	21	9	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill)	...	...	...	...	...	...	...	...	...	...	...
XXX.	Castle Toward	3.84	— .35	.60	5	13	80.0	26	42.0	30	0	...		
XXXI.	Mull (Quinish)	6.50	...	.95	20	18	...	...	...	...	...	...
XXXII.	Leven (Nookton)	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	3.36	...	.67	21	11	...	...	...	...	...	...
XXXIV.	Braemar	3.14	— .30	1.30	22	12	78.8	27	32.3	13	0	5		
XXXV.	Aberdeen	.98	...	.28	22	9	79.0	25	38.1	3	0	1
XXXVI.	Loch Broom	2.76	...	.46	4	11	...	...	...	...	...	...
XXXVII.	Portree	7.74	+ 2.96	1.04	3	25	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	2.12	+ .20	.90	23	16	81.2	20	38.8	14	0	2		
XXXIX.	Helmsdale	2.03	...	.47	30	12	...	...	...	...	...	...
XL.	Sandwick	1.45	— .09	.35	3	12	74.4	24	42.6	4	0	0		
XLI.	Caherciveen Darrynane Abbey	2.56	...	.47	14	18	...	...	...	...	...	...
XLII.	Cork	.85	...	.30	15	7	...	...	...	...	...	...
XLIII.	Waterford	1.39	— 1.60	.46	14	12	82.0	26	42.0	17	0	...		
XLIV.	Killaloe	3.16	— .47	.74	4	15	86.0	26	36.5	2,14	0	...		
XLV.	Portarlington	1.33	— 1.92	.28	5	13	82.0	26	40.0	9	0	...		
XLVI.	Monkstown, Dublin	1.42	— 1.19	.58	8	9	...	...	...	...	...	...
XLVII.	Galway	2.27	...	.34	2	20	80.0	27	40.0	1,14	0	...
XLVIII.	Ballyshannon	2.08	...	.40	4	14	...	...	...	...	...	...
XLIX.	Waringstown	2.47	...	.34	4	19	80.0	26	39.5	5	0	0
L.	Edenfel (Omagh)	2.12	...	.58	4	16	72.0	21	38.0	5	0	...

* And 21. † 28. ‡ 26.

† Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON JUNE.

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.—Month remarkable for the sudden and frequent changes, of both temperature and wind, the latter especially; very little T, and on the whole a dry month, but not altogether unfavourable to vegetation, which nevertheless keeps late, wheat in a general way being scarcely in ear on the 28th, an unusually late period; most crops want rain, which is also needed in many places for domestic purposes.

SELBORNE.—A cloudy month, with less than the average rainfall. The TS on the 28th was but little felt here (only a few drops of rain falling at 5 p.m.) although very violent within a few miles. Prevailing wind in first week S.W., latter part of month variable.

BANBURY.—9th, 5.25 p.m., very dark with rain; 21st, TS; two fires were caused by L on this day at Greatworth, in Northamptonshire.

CULFORD.—The grass was crisp with frost on the night of the 2nd; on the night of the 10th the temp. fell to 31°; mean temp. of the month was 59°·1, only slightly under that of June, 1875. Easterly or polar winds prevailed during nine days.

SPROWSTON.—28th, fog in morning, brilliant and warm day, T in evening; 29th, fine day, with T in evening. Rainfall about the average for the month, but for the first six months of the year more than 3 inches above it.

BODMIN.—Average temp. of the month 62°·9; rainfall considerably below the average of the last 27 years.

HAUGHTON HALL, SHIFNAL.—This has been on the whole a pleasant month, and has made up in some measure for the dry and backward spring. The much required R came on the 3rd, and fell daily till the 9th, inclusive, accompanied by a TS on that day from S.W., after that R fell slightly at intervals till 21st, when three consecutive falls of ·19 in., ·61 in., and ·60 in., ushered in by a severe TS, with ther. at 81° did effectual good to swedes and root crops, although too late to benefit the hay crops much. From that date it remained dry, with a change of wind to N. and N.E. Bar. remarkably steady, the range being only from 29·45 to 29·85. Turtle dove first heard on the 2nd; foxglove in blossom on 17th, and wild rose on 20th.

ORLETON.—A fine month, with a variable temp. and much sunlight, the first half generally cold, and the latter fine and warm; the mean temp. slightly above the average. R generally in small quantities, and total much below the average. T and L on 9th, and T on 21st.

LEICESTER.—Heavy R (·65 max. of month) on the evening of the 13th. Nearly all the R fell in the first half of the month; very hot on 20th and 21st, TS on the latter date, but only ·05 of R fell here; mean temp. of month, 57°·6. The weather during the month was very favourable for vegetation, which was very backward in May. Hay harvest not general at the close of the month.

BOSTON.—T and L on 22nd. From 9 a.m. to 6 p.m. on 23rd, 1·40 of R fell.

GRIMSBY.—T at 2.45 p.m. on 12th, T and R at 4.30 a.m. on 22nd, and sheet L at night, and T and R at 4 a.m. on 23rd. Four sheep killed a few miles hence, and houses were struck in some parts of the country. Wild rose began to flower on 13th. A fine month, bar. steady. Corn crops not heavy, but those of hay and clover good, and grass in pastures abundant. Good promise of root crops, and trees have made long shoots. In many places the frosts ruined the gooseberries, and wall fruit is scarce.

MANSFIELD.—21st, very sultry, T and L; 22nd, showery; 23rd, a thorough downpour all day, total fall, 1·19; 24th to the end, warm, dull, with alternate sunshine, but no rain till 30th, and then only ·01. The month has been a very pleasant one, very little T; max. bar. on 1st; min. bar. on 5th, mean temp. at 9 a.m. 60° 5.

MANCHESTER.—T in after part of 16th.

ARNCLIFFE.—A beautiful sunny month, with R enough to enrich the grass lands.

NORTH SHIELDS.—T on 21st, 22nd, 23rd, and 28th; L on 29th, with remarkable fall of R about midnight, ·50 falling in less than a quarter of an hour.

SEATHWAITE.—T and L on 20th.

WALES.

HAVERFORDWEST.—General character of the month to the 19th cold and ungenial, days of bright sunshine with easterly winds, cloudy days with westerly and N. westerly winds; some nights of severe cold. On the 20th, sudden intense heat (79·5) with cloudless sky and half a gale from the E. Weather electrical and much disturbed, with great heat for three or four days; after which weather warm and pleasant to the end. Ther. at or above 70° on six days. In consequence of the extreme dryness of the season, the hay crop is very light and deficient.

MACHYNLLETH.—A very fine month, rather dry for this part. T on 21st at 1 p.m. and distant T on 27th, about 3 p.m. Very stormy on 17th.

LLANDUDNO.—Fine month, temp. slightly above the average. It rose to the unusual height of 86° on 20th, followed by a TS on 21st, with heavy fall of R. Began to cut hay on 22nd; oats, wheat, and barley shot on 23rd.

SCOTLAND.

DUMFRIES.—A fine breezy month, without violent winds. Mean temp. 56°·7, 3° higher than last year; T only heard once; R about the average.

HAWICK.—High winds on 3rd, 4th, 5th, 7th, and 21st. General failure of gooseberries, and great complaints of the light crops of strawberries, caused by the frosts of May. Currants are beautiful, and apples and pears have set well. The fine rain of the 21st and 22nd were most beneficial, and blessed by the genial sun during the last eight days, the crops are progressing most rapidly.

CASTLE TOWARD.—The weather in the beginning of the month very changeable and cold, heavy falls of H occurring during the month. We had some very warm days; on the 26th the ther. registered 80°, which is the highest we have had for years. Things in general are a little late, but not so much as was anticipated. Turnips and potato crops are looking well in this district.

BRAEMAR.—A seasonable month throughout, with the exception of a rather severe frost on the 13th. Crops looking well.

ABERDEEN.—A month of fine, warm, but too dry weather. Temp. very slightly above the average. Rainfall about half the average.

LOCHBROOM.—From 3rd to 8th cold and stormy, after then generally dry and fine. Vegetation much retarded by want of warmth and rain.

PORTREE.—A very wet, stormy month, the wettest (7·74) June on record, the fall being 3 in. above the average. Heavy H showers on 4th, 5th, 6th, and 7th; gale from S. on 10th from 6 to 8 p.m. Solar halo on 18th from 5 to 8.30 p.m.

CULLODEN.—High winds on 4th and 19th, S. to S.S.W.; H on 9th; very hot on 20th, 81°·2 in the shade, and 135°·2 in the sun, wind S. to S.E., brisk breeze, bright and clear sunshine. 25th, 78°·8 in shade, 135° in sun; brisk wind, E.S.E.

SANDWICK.—A very pleasant month, from 19th to end it was warm for this latitude, the temp. in the shade on the 24th reaching 74°·4, and in the sun 104°·3, while there was a difference of 13°·1 between the wet and dry ther. Only ·23 of R fell from the 7th to the 30th, and the farmers were very pleased to have ·28 on that night.

IRELAND.

DARRYNANE.—R about the average, and has been of great service to the crops, and above all to the grass, which was very backward. Winds variable, usually moderate, but fresh gales on 3rd, 14th, and 21st, all from W. High sea on 20th and 21st.

MONKSTOWN.—Very fine and generally warm month, latter part very dry, only .01 in. of R from 16th to the end.

BALLYSHANNON.—The weather during the month has been good for the growth, and crops have progressed favourably, with the exception of flax, which will be a poor crop here in consequence of the continued drought. Rainfall less than the corresponding period last year by 1.35 in.

WARINGSTOWN.—Warm, stormy, and changeable.

OMAGH.—A very favourable month, the R and warmth of which have well nigh remedied the damage done by an unprecedentedly inclement spring.

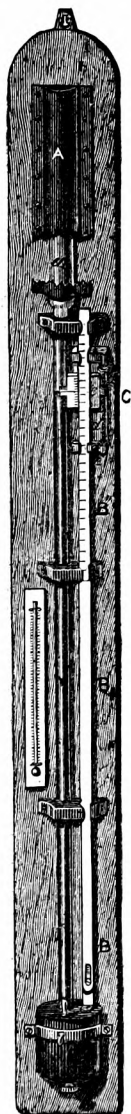
SUPPLEMENTARY TABLE OF RAINFALL IN JUNE, 1876.

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

Station.	Total Rain. in.	Station.	Total Rain. in.
Acol	1.68	Llanfrechfa	1.92
Hailsham	2.15	Castle Malgwyn ..	1.93
Andover.....	2.07	Heyope	1.62
Strathfield Turgiss	2.06	Rhug, Corwen	1.28
Addington Manor.....	1.59	Port Madoc	2.54
Oxford	1.96	Melrose	3.16
Cambridge.....	1.60	Cessnock, Glasgow	3.09
Sheering	1.28	Gruinart	4.27
Ipswich	1.68	Keith	1.12
Diss	2.10	Strathconan	3.20
Swaffham	2.17	Springfield, Tain	2.06
Compton Bassett	1.43	Skibbereen	1.17
Dartmoor	3.98	Glenville, Fermoy	1.27
Teignmouth	1.16	Tralee.....	2.88
Torrington (Langtree) ..	2.24	Newcastle W., Limerick	1.46
Trevarrick, St. Austell..	1.49	Kilrush	1.22
Taunton	1.45	Kilkenny	1.11
Bristol .....	...	Kilsallaghan	1.83
Sansaw	1.90	Twyford, Athlone	1.69
Cheadle	2.91	Ballinasloe.....	1.54
Ashby-de-la-Zouch	2.43	Kylemore	6.11
Coston, Melton Mowbray	2.25	Bangor	4.99
Bucknall	2.70	Carrick on Shannon.....	1.83
Walton, Liverpool	2.58	Rockcorry	1.41
Broughton-in-Furness ..	4.76	Warrenpoint	2.48
Stanley, Wakefield	1.96	Bushmills	2.97
Gainford	2.42	Buncrana	2.57
Shap	4.53		

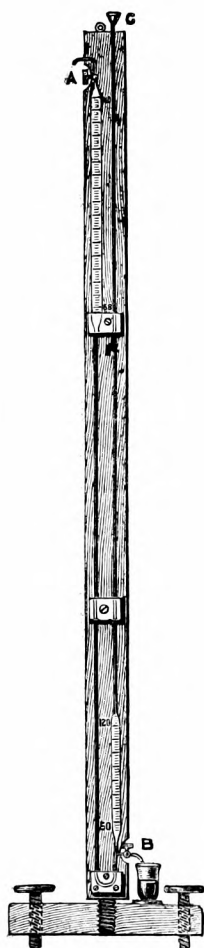
BAROMETERS, &c.

Fig. 21.



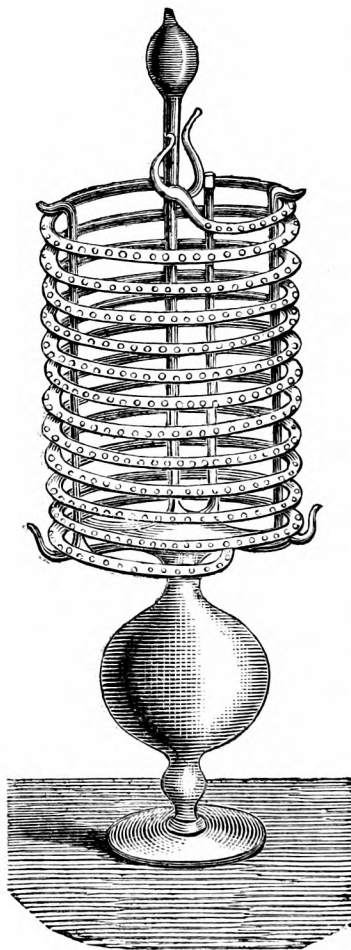
Krueger's
Barometer.

Fig. 22.



Bohn's Barometer.

Fig. 23.



Cimento Thermoscope.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXVII.]

AUGUST, 1876.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

SCIENCE AT SOUTH KENSINGTON.

(Continued from page 84).

OUR articles on the Loan Collection seem to resemble the exhibition itself. It was a long while being prepared, after it was opened very many changes had to be made, and still it is far from perfect. So is it with our notes; they require considerable care, and after all, we cannot claim that they are perfect. For example: knowing that many of the instruments had been photographed, we relied upon being favoured with negatives for the use of our engraver; there was some red tape between the positives and the negatives, and not a print was to be had, consequently several of the engravings in our last had to be made from hurried drawings; one block had to go to the printer without our seeing it, and that one *alone* was incorrect. We, therefore, re-engrave Prof. Krueger's Barometer (fig. 21), together with the following brief explanation:—

- a. Upper part of barometer tube.
- A. Covering of ditto.
- B B' B". Scale of barometer, clamped by the screw below B.
- C. Frame sliding on B" and carrying the vernier c.
- d. Screw for adjusting the vernier.

Dr. Bohn, of Aschaffenburg, has favoured us with a letter, from which the following are extracts, and has sent a sketch of an improved form of his barometer, which we reproduce in fig. 22:—

- (1). In fig. 14 the tube *c* with the funnel must be higher than the end of *A*, otherwise the mercury cannot be driven out of *A* by filling *c*.

The short tube forming the end of *a* is represented as joined by a piece of rubber tubing; when depressed it would be below *c*, but perhaps not sufficiently.

- (2). In fig. 14 the stopcock *B* is incorrectly placed. In the position shown in the engraving a two-way cock would be necessary; although easy to invent, it would not be easy to make in glass. My own apparatus has near the knee a branch tube ending in the stopcock *B*.
- (3). My barometer is *not* only adapted for laboratory use; I use it myself for altitude measurements. I have, however, attached it to a slab of wood, with a screw at the lower end,

which enters the top of a tripod. When the barometer is filled, it can be unscrewed, and hung against the wall of a room. For safety during transit I empty the tube of mercury, close the tap *A*, and put an india-rubber stopper in *c* in order to exclude damp air. The board and tube fit in a leather sheath, and can be carried across the shoulders. The once-dried mercury, if carried in a well-stopped earthen bottle, needs no more warming. Arrived at the station, the board is screwed to the tripod, and in less than twenty minutes the barometer is filled and ready for an observation.

These alterations have virtually made it another instrument, and in its present form it most readily compares with Stevenson's Iron Barometer (fig. 6, p. 69); but taps at the top of barometer tubes appear to us extremely objectionable.

WILD'S ADJUSTABLE SYPHON BAROMETER.

This furnishes another illustration of the difficulty attending the compilation of this series of articles. One of these instruments is exhibited by the Geneva Association for Constructing Scientific Instruments, and another by the Meteorological Committee. In the catalogue the former refer for a minute description of the construction to the "*Mélanges physiques et chimiques tirés du Bulletin de l'Académie Impériale des Sciences de St. Petersburg, Vol. ix., Sept. 23rd, 1875.*" As the Meteorological Committee exhibited one of the instruments we thought that they would have a copy of this description, but there does not appear to be one in their library; a search at the British Museum was equally in vain; then we tried the library of the Royal Society, but rich as it is in the journals, &c., of foreign scientific bodies, no copy of the above paper can be found. We have, therefore, written to Geneva for details, which we hope to give in our next.

GLYCERINE BAROMETER.

This is a very great improvement upon the old water barometers, which were vitiated by the elastic force of the vapour in the upper part of the tube, which Mr. Jordan somewhat quaintly calls "back pressure"—however, in other respects his description is so good that we transfer it almost *verbatim*.

This instrument is designed for the purpose of affording a delicate "weather glass" indicating small changes of pressure by large oscillations of a fluid column, at the same time preserving all the accuracy of the mercurial barometer. The fluid used is glycerine in a maximum state of purity, which has a specific gravity of 1.26, or about one-tenth that of mercury. It has the advantage, from its high boiling point, of giving a vapour of very low tension in the Torricellian vacuum, and is, therefore, free from the masking effect of back pressure which interferes with the indications of a water barometer. The fluctuations of the column are observed in a glass tube of 1 inch sectional area, or 100th that of the cistern. The tube forming the body of the instrument is an ordinary composition gas-pipe $\frac{5}{8}$ inch

diameter, 27 feet long, placed in the well of the staircase, between the upper and lower galleries. The exposed surface of the glycerine in the cistern is protected by a layer of paraffin oil in order to prevent absorption of moisture. The divided scale on the right hand side is in inches and tenths in absolute measure, while that on the left shows the equivalent values reduced to a column of mercury.

THERMOMETERS.

The second edition of the catalogue is now published. We lay it under contribution as far as practicable, but as it occupies more than a thousand pages, and the "sorting" is still most drolly uncertain, we can only do our best towards finding what there is in the collection. As a specimen of the sorting, we may quote that of a "Registering Thermometer," by Fontani (1828), which is placed under Section II., Astronomy, and in Group III., "Objects illustrating the History of the Telescope" !

We are not sure that there is much to be learned at the exhibition respecting thermometers by those who are acquainted with what has been done in this country within the last quarter of a century, for our continental friends have sent very few.

Before proceeding to thermometers, we must, however, call attention to the unique and most interesting collection of the thermoscopes of the Academy of Cimento. Regarded either as relics of a bygone age or as specimens of glass blowing, they are alike remarkable ; indeed, as regards the latter point, we believe that there are few glass blowers who could make a copy of the most elaborate of these instruments.

We have not called them thermoscopes from the slightest disrespect, on the contrary the Academicians of Cimento must have been splendid fellows, whom any one who loves science for its own sake would honour. By thermoscopes we wished to imply that, though exquisitely made and very delicate, they are not thermometers, inasmuch, as the scales are somewhat arbitrary, the method of graduating by the freezing and boiling points of water not having been devised.

As all our readers cannot go to South Kensington, we give an engraving of one of these thermoscopes (fig. 23), reproduced from a rare old book in our possession.* It is strange, yet pleasant, to be able more than two centuries after the thermoscope was made and engraved, to see how truthfully the ancient draughtsman did his work. Some faint notion of the skill and perseverance of the glass blower may be formed from the fact that the coiled instrument is 1 foot high, and the thermoscope tube *seven and a half feet* long. There are also among the instruments of this venerable Academy some which appear to us designed for use as "clinical thermometers"—if so, verily there is nothing new under the sun.

* *Essayes of Natural Experiments made in the Academie del Cimento, under the protection of the Most Serene Prince Leopold of Tuscany. Written in Italian by the Secretary of that Academy [1667].* Englished by Richard Waller, Fellow of the Royal Society. London, Printed for Benjamin Alsop at the Angel and Bible in the Poultry over-against the Church. 1684.

The thermometers have been somewhat arbitrarily divided by the obviously rival claims of the departments of "Physics—Instruments for the Measurement of Heat" and of "Meteorology." Consequently some are in the Physical gallery, and some are down among the Meteorological instruments, but as there are a good many duplicates it does not very much matter.

All, or nearly all, the best English makers exhibit, but Negretti and Zambra send the greatest variety of patterns, among others two pairs of thermometers, illustrating (what nobody would deny, but everybody does not realize) the advantage of enamelling the backs of thermometer tubes, and of using porcelain for the scales—both methods introduced by them, and generally copied by the trade. The same firm exhibit a thermometer with gridiron pattern bulb, so fragile and delicate that one almost expects to see it rise when one looks at it through the thick plate glass. More practically useful are, however, their standards, with which they and Casella run a neck and neck race. It would, perhaps, have been better had certificates been sent with all thermometers, but even then those instruments alone would have been shown which had extremely good certificates, and we all know that the best makers could mostly have found among their stock, absolutely perfect thermometers.

It will probably be sufficient if we enumerate some of the typical patterns exhibited, and refer to the volumes of this magazine in which full descriptions have been given.

Solar Radiation Thermometers. Negretti's with enclosed pressure gauge, and Hicks's with platina wires for testing the vacuum by the stratification of the electric discharge (Vol. IX. p. 34).

Terrestrial Radiation Thermometers. Hicks's double cylinder (Vol. VIII. p. 156, and IX. p. 34,) and Casella's extra sensitive bifurcated, which, in spite of its excellence, has apparently never been described in these pages.

Negretti's patent recording thermometer for land use, with clock so as to record the temperature at any required time and as arranged (Vol. IX. p. 35), for determining the temperature at any depth in the ocean, independently of any temperature higher or lower through which the instrument may have to pass.

The only other English thermometer claiming notice is an improved form of Six's thermometer, exhibited by S. G. Denton. Increased sensitiveness is gained by employing a long and very thin flat bulb—a flattened cylinder.

As we have stated above, the foreign thermometers exhibited are not numerous, nor do they strike us as being good. We are not objecting to the workmanship so much as to the pattern of the instruments. Holding, as we do, that the degree marks should be etched upon the tube, we regret to see that this practice is rarely adopted except in this country. The English maker places a clear thin line across the tube, and usually these lines are not closer than twenty to an inch—they are therefore easily seen, easily individualized, easily

counted, and the intervening space is easily subdivided. The Continental makers* put no divisions on the thermometer tubes, but place an opal glass scale behind them, with very fine divisions (often 50 or 60 to an inch) and then plunge thermometer and scale into a glass tube for protection. We trust that we are superior to any feeling of nationality; in science every one should aim at, and adopt that which is best, but we do not like these thermometers. Perhaps some of our Continental friends will reply to the following objections which appear to us to attach to the form of thermometer which they exhibit, and which is also employed in the sets of apparatus exhibited by the Russian, German, and Norwegian authorities.

- (1). The thermometer, being dropped into a closed cylindrical tube, its sensitiveness to changes of temperature will be diminished by the time requisite to change the temperature of (a) the glass tube, and (b) the air contained in it.
- (2). The parallax error is probably greater when the divisions are on a slab at the back of a thermometer, than when they are on the tube in front.
- (3). If the attachment of the tube to the scale becomes loosened, the accuracy of the thermometer is vitiated.
- (4). We believe that greater accuracy is obtained with moderately open scales by estimation of the proportional parts, than by minute subdivisions which, if closer than about 30 to an inch, are not easily counted, especially when enclosed in a tube and read (as meteorological thermometers must be) out of doors, and by artificial light.

The following thermometer has besides the above peculiarities (we will not call them faults), another feature which we can hardly pass without comment.

1015A. Thermometer with Corrected Freezing Point.

W. Gloukhoff, St. Petersburg.

"This thermometer is constructed on a principle much used in Germany. To it is added only a contrivance to render the scale more steady, and to correct the error of *freezing point*, by raising or lowering of the scale. By unscrewing the metallic cap of the thermometer this contrivance becomes visible."

Putting aside the somewhat unusual phraseology of this paragraph, for which probably the translator is responsible, we find that the thermometer has a scale which is adjustable at pleasure, and is to be adjusted from time to time in accordance with the shifting of the zero point. We consider that this implies and involves two additional errors.

- (1). If the zero point shifts sufficiently to require mechanical correction, it implies that the tube has not been kept long enough between filling and the application of the scale.

* In the following remarks we refer only to those makers who have exhibited, especially to the eminent firms of Geissler and Son, of Berlin, and Haak, of Neuhaus am Rennweg. We are aware that the best French makers (who, however, do not exhibit) adopt the English mode, and that Haak has sent one pair of good thermometers divided on the stems.

- (2). If the scale can be shifted, it is useless to compare the instrument at an observatory, or preserve any copy of the verification, and the accuracy of all observations depends, not on the practised skill of the manufacturer, or on that exercised at the central observatory, but on the comparisons made by the observer, which may or may not be accurate, and on adjustments the amount of which may or may not be duly entered in the journals and applied to the observations.

THERMOMETERS FOR SOIL TEMPERATURE.

There are five exhibitors of thermometers for this purpose ; they all send different patterns, and the entries are scattered indiscriminately through the catalogue. In Section 8—Heat, we find (but oddly enough it has dropped out of the 2nd Edition of the catalogue).

1015. **Thermometer.** 2 in. [should be 2 m. or $6\frac{1}{2}$ feet] long, set in wood and zinc, divided into $\frac{10}{5}$, for investigations of terrestrial heat.
Warmbrunn, Quilitz & Cie., Berlin.

This appears to be a round rod (probably slit like a cedar pencil) of about 2 in. diameter, and $6\frac{1}{2}$ ft. long, with a long thermometer in the centre, the scale being visible through part of the upper wood being cut away. The whole is cased in zinc, soldered on, but leaving the scale visible. The bottom is a perforated brass cap with holes to allow communication with the bulb. Besides the general objections applying to reading a thermometer with one's head on the ground, and to the difficulty of checking change of zero point in deep sunk thermometers, it seems to us that this pattern has faults of its own, which might easily be remedied. The cap at the bottom is perforated with large holes. Why? to let the temperature through? Surely the designer knew that at that depth changes occur with such slowness that conductivity is of no importance. Besides, is earth so much better a conductor than the brass which he has cut away? Lastly—to give a bit of our own dearly-bought experience—we were once putting down a somewhat similar thermometer with holes scarcely half the size of these, a pebble in the clay got in at one of the holes, the clay pressed it against the bulb, and there was work for the opticians. That is merely a possible accident, but we think there is certainty of failure from another cause. These apertures will admit water, the wood must swell, and as all seems to fit tightly now, the prospect for either the thermometer tube or the zinc casing does not seem satisfactory.

(To be continued.)

THE TEMPERATURE IN JULY.

It is well known that popular opinion usually magnifies present events, and we expect each severe frost, heavy gale, or violent thunderstorm to be considered by the public at large as unprecedented. The attention devoted to the heat of the present summer seems to us, as far as relates to absolute maxima, rather excessive. We shall show

presently that the excess has been even more noticeable in other parts of England than in London. We give first the maxima recorded since 1857 by ourselves, from the same thermometer, at all times mounted upon a Glaisher stand, carefully turned.

1858	June 16	92°·6	1865	June 23	88°·2	1871	Aug. 13	90°·0
9	July 12	91°·9	6	July 13	87°·2	2	July 25	92°·3
1860	May 23	76°·1	7	Aug. 14	88°·2	3	July 22	90°·1
1	Aug. 12	89°·5	8	July 21	93°·3	4	July 20	90°·8
2	May 6	81°·1	9	July 22	91°·0	5	Aug. 16	86°·1
3	July 15	85°·0	1870	June 22	91°·2	6	July 15	92°·6
4	Aug. 5	89°·4						

From this it will be seen that in London, the usual summer extreme is almost precisely 90°; the average of the above is 88°·8, but that includes the remarkably exceptional year 1860, with a maximum of only 76°·1.

Again, out of the 19 years, there were—

10	in which the temperature reached or exceeded	90°
7	“ “ “ “ “ “ “ “	91°
4	“ “ “ “ “ “ “ “	92° and there was
1	“ “ “ “ “ “ “ “	93°

Descending to a question of tenths of a degree (the representatives of the thinnest cloud or the slightest breeze) we find that precisely the same temperature occurred in 1858 as in 1876, and in 1868 the maximum was 0°·7 higher.

Another mode of estimating the warmth of a summer is by noticing the number of days on which the maximum reaches or exceeds 80°—this is shown in the following table:—

1858	...	24	.....	1864	...	23	.....	1870	29
9	...	25	.....	5	...	23	.....	1	19
1860	...	0	.....	6	...	13	.....	2	19
1	...	12	.....	7	...	10	.....	3	10
2	...	2	.....	8	...	40	.....	4	16
3	...	13	.....	9	...	15	.....	5	8
								6	18+

We have attached a + to 1876, as we cannot tell how many more such days there may be this year; after this date, August 8th, the average number is 4. According to that, the above table shows that the “days of 80°” have been much more numerous than usual, but by no means unprecedentedly so.

Respecting the maxima in different parts of the country we append a few letters, others are epitomized in the following statement, and further details will be found in our usual monthly table and remarks.

Div. I. Enfield, Middlesex.—15th 92°·0, 16th 91°·4, 17th 92°.—T. PARLIN.

II. Worthing, Sussex.—19th 84°·3; previous max. 1871, Aug. 13th and 14th, 84° and 85°·1 respectively.—W. J. HARRIS.

„ Newport, Isle of Wight.—17th 87°·1, exceeding even 1868 by 0°·7.—E. G. ALDRIDGE

„ Woolston, Southampton.—15th, 88°·0; 16th, 86°·5; 17th, 92°·0.—F. EKLESS.

IV. Hillington, Norfolk.—14th, 89°·1; 15th, 83°·5; 16th, 88°·0.—H. FOLKES.

- VI. Hereford.—14th, $94^{\circ}0$; 15th, $96^{\circ}1$; 16th, $95^{\circ}2$; $96^{\circ}1$ occurred also July 22nd, 1868.—E. J. ISBELL.
 „ Wolverhampton.—14th, $92^{\circ}2$; 15th, $90^{\circ}2$; 16th, $92^{\circ}8$; previous max., 1868, $91^{\circ}3$, July 21st.—J. THRUSTANS.
 X. Gainford, Durham.—14th, $83^{\circ}9$; 15th, $84^{\circ}1$; 16th, $89^{\circ}5$.—A. ATKINSON.
 „ Bingfield House, Northumberland.—14th, $76^{\circ}0$; 15th, $82^{\circ}0$; 16th, $87^{\circ}0$.—J. COPPIN.

To the Editor of the Meteorological Magazine.

SIR,—The supposed influence of the moon on the weather is becoming discredited, and various theories of our early days are being exploded by the advance of meteorological science; but St. Swithin still seems determined to attract attention, and by his vagaries to sustain the spirits of those who reluctantly give up the fables of the nursery or school-room, and quite look forward to their favourite saint's day for some unusual manifestation, if not for some insight into the future.

Last year the 15th of July was a very cold day (max. only $61^{\circ}7$) with incessant rain, amounting in the aggregate to 1.433 in., the total rainfall of the month reaching 4.631 in.

This year the day was one of very exceptional heat (max. $94^{\circ}1$), and the month's rainfall up to the date of this letter has only been 0.060 in.

The shade maxima of the last few days, following cool nights, have been so remarkable that I append my readings.

I am, dear Sir, yours truly,

PERCY BICKNELL.

Fozgrove, Beckenham, Kent, 18th July, 1876.

		9 a.m.					
		Dry.	Wet.			Min.	Max.
July 14	...	$76^{\circ}9$	...	$67^{\circ}9$	...	$52^{\circ}3$	$91^{\circ}3$
15	...	$77^{\circ}5$	...	$69^{\circ}0$	...	$54^{\circ}6$	$94^{\circ}1$
16	...	$74^{\circ}0$	...	$67^{\circ}2$	...	$55^{\circ}7$	$92^{\circ}1$
17	...	$80^{\circ}3$	...	$68^{\circ}4$	...	$58^{\circ}5$	$91^{\circ}3$

Previous readings of 90° and upwards.

1870	June 22	...	$90^{\circ}8$	|	1873	July 22	...	$90^{\circ}6$
1871	Aug. 12	...	$90^{\circ}8$	|	1874	July 9	...	$92^{\circ}6$
1871	Aug. 13	...	$90^{\circ}0$	|	1874	Aug. 19	...	$91^{\circ}7$
1872	July 25	...	$90^{\circ}0$	|	1875	None		

To the Editor of the Meteorological Magazine.

SIR,—The following results are derived from thermometers suspended on a Glaisher stand, 4 feet above tolerably green grass. At no time during the 24 hours does the shadow of any tree, shrub or building pass across the grass plot on which the thermometer-stand is situated.

On 11 out of the 15 days 13th to 27th the maximum temperature rose above 80° , viz., 13th, $84^{\circ}1$; 14th, $88^{\circ}6$; 15th, $90^{\circ}5$; 16th, $88^{\circ}4$; 17th, $89^{\circ}3$; 18th, $80^{\circ}7$; 20th, $81^{\circ}4$; 21st, $83^{\circ}1$; 22nd, $86^{\circ}1$; 25th, $82^{\circ}2$; and 26th, $83^{\circ}6$.

On 12 of these 15 days the difference of reading between the dry and wet bulb thermometers at 3 p.m. was more than 14° , viz., 13th, $14^{\circ}5$; 14th, $15^{\circ}5$; 15th, $16^{\circ}9$; 16th, $24^{\circ}0$; 17th, $17^{\circ}4$ (at 2 p.m. $21^{\circ}0$); 18th, $17^{\circ}0$; 20th, $15^{\circ}3$; 21st, $14^{\circ}4$; 22nd, $18^{\circ}0$; 25th, $15^{\circ}6$; 26th, $18^{\circ}1$; and 27th, $14^{\circ}8$.

On 13 of the same 15 days the range of temperature exceeded 20° ; on 12 days, 25° ; on 8 days, 30° ; and on one day, the 14th, it was as much as 35° .

Rain fell on two days only, viz., on the 23rd, to the depth of .070 in., and again on the 26th, to the depth of .004 in.

On 4 days, at 3 p.m., the direction of the wind was N.; on 2, N.N.W.; 2, N.W.; 1, W.N.W.; 2, W.; 2, W.S.W.; 1, S.S.W.; and 1, S.E. The force of the wind at the same hour amounted on 3 days to a light breeze, on 7 days to a light air, and on the remaining 5 days it was calm.

The mean amount of cloud, at 3 p.m., for the 15 days was 3.3; on 2 days the sky was overcast, and on 6, cloudless.

I remain, Sir, yours truly,

EDWD. MAWLEY.

Addiscombe, Croydon, Aug. 7th, 1876.

P.S.—During the month rain fell on 6 days to the total depth of .397 in. The greatest fall occurred on the 28th, and amounted to .110 in.

To the Editor of the Meteorological Magazine.

SIR,—The maximum temperature in shade on Sunday, July 16th, was $94^{\circ}5$, registered by a good instrument by Casella, on a wooden stand on N.E. side of house. This is the highest reading I have recorded here since I first began to observe the max. thermometer, viz., in the spring of 1860. The nearest approach was on July 22nd, 1873, when the max. was $91^{\circ}6$. As I know that you very rightly consider *time* to be an important element in all notices of meteorological phenomena, I may add that at 12.45 (on July 16th) the reading was $92^{\circ}5$, and that the extreme max. occurred between that hour and 2 p.m. Much thunder was heard in S.E. during the afternoon.

Yours faithfully,

B. T. GRIFFITH-BOSCAWEN.

Trevalyn Hall, Rosset, Wrexham, Aug. 7th, 1876.

THE TOTTENHAM STORM.

To the Editor of the Meteorological Magazine.

SIR,—A heavy thunderstorm passed over this neighbourhood last evening. Distant thunder was heard in N. and N.W. about 5.30 p.m.

Shortly after 7 p.m. the thunder became very heavy and almost

incessant, and the storm rapidly approached from N.W. ; from 7.45 to 8.30 p.m. the storm was very close, the lightning and thunder being nearly simultaneous ; at 8.15 a few hailstones nearly an inch long fell, but, fortunately they were few in number, this was followed by heavy rain for 10 minutes. The storm continued till 9 p.m., and then suddenly ceased. Distant lightning continued till 1 a.m.

At Winchmore Hill the hail was heavy, and at Southgate, Hornsey, and Tottenham the damage done is very great, some houses having nearly every pane of glass on the W. side broken, and many trees are nearly stripped of leaves.—Yours truly,

THOMAS PAULIN.

Enfield, 24th July, 1876.

P.S.—The amount of rain gauged here was only .19 in.

THUNDERSTORM OF JULY 16TH.

To the Editor of the Meteorological Magazine.

SIR,—The exceptionally hot weather of the last few days was brought to a termination to-day by a violent storm of thunder, lightning, rain, and hail, which passed over the village between 3 and 4 p.m.

The greatest shade temperatures of the last five days have been respectively as follows : Wednesday, the 12th, 76.0 ; Thursday, 13th, 79.2 ; Friday, 14th, 89.3 ; Saturday, 15th, 92.3 ; and to-day, 91.2 degrees ; the cooling process having commenced before the maximum temperature would have been reached under ordinary circumstances.

At 1 p.m. to-day the dry bulb thermometer stood at 89.3, and the wet bulb at 77.0 in the shade. Soon afterwards the clouds began to gather, and mutterings of thunder were heard, with some rain and hail. About 3 p.m. the wind, which had been slowly moving from S.W. to S., suddenly veered to W. and then to N. In the meantime the lightning became vivid, and the rolling of the thunder continuous. Two flashes especially were instantaneously followed by the peculiar crash which indicates the close proximity of the storm, and which was proved by the fact that an oak tree was struck in my garden, the bark on one side peeled off, and strewn in fragments on the ground, the same thing happening to a yew tree in a neighbour's garden, not more than 100 yards distant.

At 4.20 p.m. the dry bulb thermometer stood at 63.6, and the wet bulb at 61.6. At 5 p.m. the temperatures were 63.0 and 62.5, and at 6 p.m., 65.0 and 64.5 respectively, and the wind had backed to S.W. The barometric indications were comparatively slight, the pressure at 9 a.m. having been 29.940 (uncorrected), at 5 p.m. 29.864, and at 9 p.m. 29.814.

The greatest severity of the storm lasted from 3.15 to 3.40 p.m. At 4 p.m. there was a calm and refreshing atmosphere ; but the rain and distant thunder soon re-commenced, and lasted, with some intermissions till about six, after which the evening was very fine,

The hailstones were remarkably large, many of them about the size and form of a broad bean, and some considerably more bulky.

The canaries in the house went to roost before 3.30, but at 4.30 p.m. were again lively and in full song.

I remain, Sir, yours truly,

WILLIAM SCOTT.

Barlaston, Stoke-upon-Trent, July 16th, 1876.

To the Editor of the Meteorological Magazine.

SIR,—I will jot down a few notes of the anomalous thunderstorm of Sunday last, July 16th, as it came under my observation.

At Ashby Parva, Lutterworth (where I was), the morning was cloudless, except a few thin cirri moving slowly from W.; wind S., moderate; heat intense. No change, except slight fall of mercury, till 2 p.m., when I noticed peculiarly solid-looking cirri in W.N.W., almost like summits of nimbus. At 3 p.m. dense cirrus overspread all the W., and nimbus was visible in very distant W.S.W. The cirrus became thicker and thicker, except in S.E. and S.W., and at 3.20 it began to thunder much in W.N.W.; no cumulus, nor indeed any form of cloud, except exceedingly dense cirrus, with festooned pocky under-surface, being visible. Thunder and lightning continued, occasionally almost immediately overhead until 5.30 p.m., at an immense elevation, and totally without rain. A little rain did appear to be falling five miles to S.W. The thunder-claps were prodigiously long, but not loud; the extraordinary part of the storm (so to term it) was the almost total absence of any lower clouds. It was only about 5 p.m. that a very few little black fragments of cumulus appeared, quite detached from the high thin electric cloud above. At 6.30 it cleared to a cloudless sky, the edge of the cirrus stretching from S.W. to N.E., and moving (as throughout) from W. I heard no thunder in E. or S.E., and the storm seemed to have arisen in the West Midlands, attained a vast elevation, and expended itself before reaching the Eastern Counties.

Travelling to this place (Sellack, Ross,) on Monday, I saw no trace of rain, nor heard of any storm, till reaching Ross, where heaps of sand and mud in the fields and roads indicated heavy rain. I am told that here the storm began in the N.W. and W.N.W. about 3 p.m., reaching here about 4. It was very heavy, and the electric discharges violent, but apparently very high. Hail (large, but soft, the stones weighing about four grains a-piece) fell at 6 p.m. The storm travelled from W., and lasted about four hours. The rainfall was .66 in. The storm was severe also at Hereford, but a few miles to the N. was unfelt. It seems to have been slight at Gloucester, and only a little thunder heard at Bristol. East of this it was less heavy than here, but I am told that the lightning display was great over Worcestershire.

A thunderstorm at the centre of an anti-cyclone, accompanied with

a shift of the latter westwards, is very rare, and would not, I think, occur, except under conditions of abnormally high temperature.

Yours truly, W. CLEMENT LEY.

Sellack Vicarage, Ross, Herefordshire.

P.S.—Have you noticed the peculiar scarcity of cumulus this summer, and the prevalence of clouds of the cirrus and stratus types throughout the country?

RAINFALL OF JULY 14TH, 1875.

SIR,—I observe that on page 127 of "British Rainfall," 1875, you give the account of the Great Rainfall on July 14th, with a list of "every" station from which you have received a record of the same. I was surprised at not seeing this station noticed, because on the back of the daily record, which I forwarded to you, I had entered the time at which that storm began and ended, having carefully ascertained it by my own observation, compared with enquiries I had made from other intelligent persons in this village.—Yours faithfully,

HENRY MILLER.

Ashbury Vicarage, Shrivenham, Berks, July 31st, 1876.

[We plead guilty to the above charge, but we are very glad that we did it, because it now comes as a test of the accuracy of the theoretical curves shown upon the map on p. 128 of the work referred to.

Ashbury is in lat. $51^{\circ} 35' N.$, and lon. $1^{\circ} 40' W.$, about nine miles W.S.W. of Wantage, and, therefore, the figure stated by Mr. Miller would have been placed precisely upon a spot upon the 8 o'clock line, or to put it in the simplest form the matter stands thus. We calculated that the rain on July 14th, 1875, began at Ashbury at 8 a.m.; we now find that the over-looked entry was as follows:—"July 14th, continuous rain from the East for 39 hours, from 8 a.m. on the 14th to 11 p.m. on 15th; during part of the time very heavy."

This confirmation is so satisfactory, that we think that Mr. Miller will agree with us that (though we ought not to overlook anything) it is fortunate that we were guilty.—Ed.]

THE GLASGOW METEOROLOGICAL BREAKFAST.

The attendance at our breakfast having risen from 15 in 1874 to 20 in 1875, apparently indicates the general approval by Meteorologists of the arrangement.

A similar inference may fairly be drawn from the fact that we have received from Dr. Muirhead, of Bushy Hill, Cambuslang, authority to invite in his name, all the Meteorologists attending the Glasgow Meeting to breakfast, at 9 a.m. (doors open at 8.30), on September 11th, at the Regent Hotel, Sauciehall Street, which is the nearest to the Sectional Rooms.

The arrangements (except that there will be no payment) will be exactly the same as in previous years, viz:—All persons interested in Meteorology will be welcome, but, in order to allow of proper provision being made, they are requested to intimate to the Editor of this Magazine as early as possible their intention of being present.

JULY, 1876.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which "1 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.		
											inches.	in.	In shade	On grass
		inches	inches.	in.			Deg.	Date.	Deg.	Date.		
I.	Camden Town	·82	— ·98	·27	28	7	92·6	15	47·3	12	0	0
II.	Maidstone (Linton Park)	·70	— 1·28	·22	31	9	94·0	15	49·0	12	0	0
	Selborne (The Wakes)	·92	— 1·28	·23	31	10	86·5	15	41·0	12	0	0
III.	Hitchen .....	...	...	...	...	...	...	...	...	...	...	...
	Banbury	·70	— 1·36	·27	6	11	88·0	15	42·0	12	0	0
IV.	Bury St. Edmunds (Culford)	1·39	— ·60	·57	31	8	85·0	15	44·0	31	0	0
V.	Norwich (Sprowston) .....	...	...	...	...	...	...	...	...	...	...	...
"	Bridport	·82	— 1·29	·47	6	6	...	...	...	...	...	...
"	Barnstaple	1·27	— 1·59	·36	31	10	94·0	16*	47·5	14	0	0
"	Bodmin	·98	— 2·13	·36	6	13	82·0	16	44·0	12	0	0
VI.	Cirencester	·98	— 1·46	·34	6	8	...	...	...	...	...	...
"	Shifnal (Haughton Hall)	3·62	+ 1·45	1·12	31	10	84·0	16	41·0	12	0	0
"	Tenbury (Orleton)	1·74	— ·64	·50	6	10	93·0	15	40·0	12	0	0
VII.	Leicester (Belmont Villas)	·69	...	·23	6	10	93·2	16	44·5	12	0	0
"	Boston	1·80	— ·50	·96	22	8	90·0	16	45·0	12	0	0
"	Grimsby (Killingholme)	2·80	...	·72	22	12	82·0	16	48·0	3, 12	0	0
"	Mansfield	1·95	...	·72	22	9	91·5	16	41·7	3	0	0
VIII.	Manchester	3·57	+ ·88	1·00	26	15	95·0	16	45·0	12	0	0
IX.	York	2·00	+ ·06	·76	26	4	85·0	...	45·0	...	...	...
"	Skipton (Arncliffe)	3·88	+ ·65	·90	26	17	86·0	15	35·0	11	0	0
X.	North Shields	2·74	+ ·93	·68	23	15	82·5	16	47·5	3	0	0
"	Borrowdale (Seathwaite)	6·05	— 2·09	1·72	25	16	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	2·85	— ·45	·65	5	9	86·6	15	39·5	11	0	0
"	Machynlleth	5·41	...	·90	6	16	86·0	15	...	...	0	0
"	Llandudno	2·28	— ·01	1·59	26	8	86·6	16	48·9	18	0	0
XII.	Dumfries (Crichton Asylum)	1·79	— ·74	·50	30	14	83·5	15†	42·7	27	0	0
"	Hawick (Silverbut Hall)	1·29	...	·31	30	8	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill)	3·24	...	·91	30	16	80·0	17	43·5	27	...	...
XV.	Castle Toward	3·78	+ ·64	·51	8	17	76·0	23	39·0	3	...	...
XVI.	Mull (Quinish)	4·51	...	·90	11	14	...	...	...	...	...	...
"	Leven (Nookton) .....	...	...	...	...	...	...	...	...	...	...	...
"	Grandtully	1·67	...	·50	7	11	...	...	...	...	...	...
XVII.	Braemar	1·67	— ·61	·35	22	14	82·0	16	35·8	3	0	1
"	Aberdeen	1·60	...	·59	22	17	85·5	16	45·2	3	0	0
XVIII.	Loch Broom	2·53	...	·40	22	17	...	...	...	...	...	...
"	Portree .....	...	...	...	...	...	...	...	...	...	...	...
"	Inverness (Culloden)	2·24	— ·43	1·28	22	14	82·9	16	44·8	3, 27	0	0
XIX.	Helmsdale	2·02	...	·82	22	12	...	...	...	...	...	...
"	Sandwick	3·15	+ 1·26	·88	17	24	76·0	16	42·8	27	0	0
XX.	Caherciveen Darrynane Abbey	2·35	...	·70	26	12	...	...	...	...	...	...
"	Cork	1·39	...	·74	26	6	...	...	...	...	...	...
"	Waterford	1·61	— 1·71	·97	26	6	81·0	15†	47·0	6	0	0
"	Killaloe	2·23	— ·96	·53	31	13	92·0	16	38·0	27	0	0
XXI.	Portarlington	1·42	— 2·12	·50	27	11	90·5	16	44·0	26	0	0
"	Monkstown, Dublin	·90	— 1·53	·71	26	6	...	...	...	...	...	...
XXII.	Galway	3·39	...	1·03	27	16	91·0	16	42·0	3, 6	0	0
"	Ballyshannon	2·44	...	·52	31	11	...	...	...	...	...	...
XXIII.	Waringstown	1·91	...	·70	30	12	89·0	16	43·0	11§	0	0
"	Edenfel (Omagh)	2·04	...	·62	6	15	82·0	15	36·0	24	0	0

* And 17. † 16. ‡ 16, 19. § 26

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON JULY.

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 dry month, and from the 12th to 27th a very warm one. The hottest days being 15th, 21st and 22nd. Bar. mostly steady and high, and the thunderstorms so prevalent elsewhere did not extend to this district, except in a very limited degree. Winds, though often changing, were never high. Towards the end of the month R much wanted by all kinds of crops, even the ripened corn would have benefited by it.

SELBORNE.—Prevailing winds first 10 days, more or less, S. and W., the rest of the month till near the end N.E. and N.W. The hottest and driest month for many years; the mean max. during 10 days from the 13th, was $81^{\circ}6$; 13th the hottest (max. $86^{\circ}5$) during the last 12 years, except the 27th of July, 1869, when it reached 89° ; the max. on 17th, 86° .

BANBURY.—TS on 16th, and distant TS at 6 a.m., and again at 6 p.m. on 23rd.

CULFORD.—Easterly winds prevailed on 10 days. Mean temp. of the month $64^{\circ}7$, or 5° above that of July, 1875, while the rainfall is little more than one-fifth of what fell in that month. T on 8th and 23rd.

BODMIN.—Mean temp. $66^{\circ}7$. Rainfall of this month has been 2 in. below the average of the last 27 years.

HAUGHTON HALL, SHIFNAL.—Although this has been an unusually hot July, this district was so favoured with copious falls of R as to escape the burning up of more southern parts. The violent TS, however, of the 16th (which did much damage in the W. of this county by cutting up the crops, and destroying the hothouses with its immense hailstones) brought little R with it here, but the next storm on the 22nd brought a fall of nearly an inch in the two hours (4 to 6 p.m.). The heat of the 14th, 15th and 16th most oppressive, otherwise the prevailing W. and N. winds allayed it generally. The difference of temp. between day and night of 12th remarkable, viz., 41° and 71° . All green crops flourishing. Barley good; wheat moderate. Not a wasp seen yet.

ORLETON.—The weather was fine and pleasant, but cool till the 12th, with a good fall ($\cdot50$) of R on the 6th, and small quantities on four other days; after a cold, bright evening on the 12th (min. $40^{\circ}2$), brilliant sunshine and great heat set in on the 13th, and continued till the 27th, when it became cooler, with wind and a stormy sky. The max. temp. of the 14th was $91^{\circ}5$, of the 15th 93° , and of the 16th $92^{\circ}5$, which is the highest, for three consecutive days, that I have ever recorded. On the 16th a great storm of T and L, with a little R, set in at 3 p.m., and continued till 6.30 p.m. Distant T was heard on 8th and 22nd. Mean temp. of the month about 3° higher than the average.

LEICESTER.—An exceedingly fine hot month. R fell in small quantities on 10 days; the total fall being $\cdot69$ in. Distant TS on 16th, 22nd and 23rd, but no storms here; on the 16th the ther. was higher ($93^{\circ}2$) than on any day since the 5th of August, 1868. Mean max. $77^{\circ}5$; mean min. $55^{\circ}2$; mean of month $64^{\circ}4$; mean max. of 10 days (13th to 22nd) $84^{\circ}4$ in.

BOSTON.—Very heavy TS, accompanied by H, on 22nd. Total fall $\cdot96$ in., max. fall of month.

GRIMSBY.—A month of real summer weather; several hot days; abundant crops of hay were got in splendid condition; and the corn crops were much improved by abundant showers. More thunderstorms than usual, viz., on 8th, 16th, 22nd, 23rd and 31st; during the storm on 16th, a horse was killed while being driven near Brocklesby Park. The driver, his wife and child, who were with him, were all unhurt. Several hundreds of panes of glass broken at East Halton by the pieces of ice which fell during this storm. On the 22nd a young man had his horse killed under him at Elsham, he being unhurt. A very heavy TS in very early morning of 23rd.

MANSFIELD.—Hot, bright and calm from 8th to 21st. A very heavy T S on 22nd, but lasted only a short time; .61 in. of R and H fell in about 10 minutes; after this storm the weather much cooler and showery.

MANCHESTER.—16th, T S at 1.30 p.m.; hailstones half-an-inch in diameter. 23rd, T S at 2.30 p.m., with H. 31st, T S.

ARNCLIFFE.—Unusual heat from 12th to 26th. Rapid hay time.

NORTH SHIELDS.—Solar halo on 6th. T S on 22nd.

SEATHWAITE.—15 days without rain, only one on which it exceeded an inch, and only two on which it reached three-quarters of an inch.

WALES.

HAVERFORDWEST.—The finest and warmest July since 1870; three weeks of magnificent weather, great amount of sunlight, the colouring of the clouds at sunset gorgeous, general appearance of the sky splendid, great dryness of the air, temp. in the shade above 80° on five days. Strong polar current on 18th caused a fall of 26°, mean temp. only 66° in the shade.

MACHYNLLETH.—Rather wet at the beginning and end of the month. Very hot and dry in the middle, and R much wanted; from 23rd R daily to the end, and at times very cold; the R fell very acceptably as the grass was very much burnt up here. T (one peal only) on 16th. A stormy cold day on 31st.

LLANDUDNO.—A month of glorious weather for pleasure seekers, though too dry for the crops; not a drop of rain from the 8th to the 25th inclusive, and the chief fall occurred on 26th, when more than 1½ inches were measured, the total fall of the month being about the average, but not so the temperature, which exceeded 62°, the average being 60°·5, the hottest day of this and many previous years here occurred on 16th, when 86°·6 was reached. L during the evening and night of 16th.

SCOTLAND.

DUMFRIES.—July has been warm and, except at the beginning and end of the month, dry. The rainfall below the average, the temp. 58°·57, being 1° higher than last year. There has not been any high wind, and T is only recorded twice, the heat compared with other places has not been great, the max. which occurred on 15th and 16th was 83°·5; no rain from 10th to 25th.

HAWICK.—A very warm month, and the hay crop has been got in to the ricks in splendid condition. Thunder showers on the 26th.

ANNANHILL.—Month generally fine. crops improving rapidly: Oats and barley looking well, also potatoes and turnips; hay crop light, pastures good and foliage abundant. T heard on 5th, 7th, and 20th.

QUINISH, ISLE OF MULL.—This month has been very cold and ungenial.

BRAEMAR.—A dry but excellent month, crops looking well. Highest temp. in shade (viz. 82° on 16th) since 1866.

ABERDEEN.—Bar above and R below the average. Mean temp. 60°·2, or 2°·8 above the mean of 19 years: this mean was only exceeded in 1868. S., S.W., W. and N.W. winds more frequent than usual. A month of fine warm dry weather, but the crops have suffered much from want of R. Max. bar. on 15th, 16th the hottest day on record (85°·5) with distant T and L. T S with fog on 22nd.

LOCHBROOM.—This has been on the whole a very favourable month for graziers and farmers; grass plentiful, stock in good condition, crops luxuriant, and the condition of this part of the country quite satisfactory. We had a heavy shower of large hailstones on the evening of the 31st.

CULLODEN.—Solar halo in forenoon of 3rd and in evening of 4th. Strong gale on 5th from S to S.S.W. and S.W.; 16th very hot, 82°·9 in shade and 138°·3 in sun; 19th very warm, 70°·9 in shade, 139°·8 in sun. 1·28 in. of R fell in less than four hours; distant T.

SANDWICK.—July has been wetter than the mean; there was a gale of 50 miles an hour from 5 to 6 p.m. on 9th, and another 45 miles an hour from 3 to 7 p.m. on 12th. T with R at 8 a.m. on 30th.

IRELAND.

DARRYNANE.—Beginning and end of month cold and wet, middle part dry and very hot with parching E. wind, which has burnt up the grass in dry soils. Hay crop very short, but potatoes except in very dry soils will be good and no signs of potatoe blight. No rain from 10th to 25th.

KILLALOE.—Month quite exceptional here. Heat very great from 12th to 25th, ranging from 81° to 90° on several days, and reaching 92° on 16th, in shade. All crops suffering from drought, pastures and meadows especially.

MONKSTOWN.—A very fine and warm month; the week, 13th to 20th, the hottest for many years. Vegetation suffering greatly from want of R.

BALLYSHANNON.—The rainfall has been less than corresponding period last year by 71 in., the temp. has been high, and crops have progressed favourably.

WARINGSTOWN.—Very dry and intensely hot. The 16th was the warmest day (max. 89°) since the 9th August, 1870, when the heat in the shade was 90°. Crops good.

EDENFEL, OMAGH.—A very seasonable month; the warmth of the third week (not equalled since 1868), though not of sufficient duration to ensure an August harvest, has saved us from an October one.

SUPPLEMENTARY TABLE OF RAINFALL IN JULY, 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	·43	Llanfrechfa	1·00
Hailsham	·58	Castle Malgwyn	2·28
Andover	·83	Heyope	2·38
Strathfield Turgiss	·93	Rhug, Corwen	2·09
Addington Manor	·83	Port Madoc	4·24
Oxford	·63	Melrose	2·20
Cambridge	1·18	Cessnock, Glasgow	2·76
Sheering	·90	Gruinart	3·26
Ipswich	·83	Keith	2·35
Diss	2·01	Strathconan	2·08
Swaffham	2·72	Springfield, Tain	1·61
Compton Bassett	·68	Skibbereen	2·55
Dartmoor	3·44	Glenville, Fermoy	1·77
Teignmouth	·59	Tralee	1·75
Torrington (Langtree) ..	1·45	Newcastle W., Limerick ..	...
Trevarrick, St. Austell..	1·24	Kilrush .....	...
Taunton	·73	Kilkenny	1·26
Bristol .....	...	Kilsallaghan	1·45
Sansaw	2·29	Twyford, Athlone	1·55
Cheadle	2·41	Ballinasloe	1·57
Ashby-de-la-Zouch	1·55	Kylemore	4·36
Coston, Melton Mowbray ..	·61	Bangor	2·14
Bucknall	1·15	Carrick on Shannon	1·24
Walton, Liverpool	2·45	Rockcorry	2·00
Broughton-in-Furness ..	2·96	Warrenpoint	1·31
Stanley, Wakefield	2·04	Bnshmills	2·78
Gainford	2·13	Buncrana	1·80
Shap	2·10		

Too late for insertion last month :—Gainford, 2·42; Heyope, 1·62; and Skibbereen, 1·17.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXVIII.]

SEPTEMBER, 1876.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE HEAT AND THUNDERSTORMS OF JULY AND AUGUST.

To the Editor of the Meteorological Magazine.

SIR,—The following are the readings of the thermometer, during the past few days of extraordinary heat:—

		9 a.m.		max.
13th	...	83°·0	...	94°·2
14th	...	81°·0	...	94°·6
15th	...	81°·1	...	92°·6
16th	...	73°·0	...	87°·4
17th	...	67°·5	...	87°·9

The max. on the 14th is the highest I have ever recorded. A violent thunderstorm occurred on the afternoon of the 15th, from 4 to 7 p.m., accompanied by heavy rain (·36 in.) ; the lightning was very vivid and frequent.

A slight storm occurred at 5.45 a.m. yesterday.—Yours truly,

THOMAS PAULIN.

Enfield, 19th August, 1876.

P.S.—Since writing the above, I have ascertained that two trees were struck in Enfield and a man was slightly injured.

To the Editor of the Meteorological Magazine.

SIR,—I send you some particulars as to the weather of yesterday, which, in all probability, as far as this part of the country is concerned, has been the hottest day of which we have any authentic records. My old Glaisher stand, which I have used for years, stands side by side with one of a modified Stevenson type ; the max. and min. thermometers intended for the latter were unfortunately at Kew for verification, and this causes my observations to be less complete than they might otherwise have been. At 9.15 a.m. the maximum temperature on the Glaisher stand had reached 84°·8, at 10.8, 88°·6 ; at 10.26, 90° ; at 10.48, 91°·2 ; at 1.15, 93°·8 ; and at some time between that and 2.15 the maximum of the day (95°·1) had been reached.

The maximum temperature in a Stevenson stand, similar to the one

upon the ground, but placed 51 ft. above it upon the top of a tower, was $91^{\circ}\cdot9$.

There was a difference of 20° between the wet and dry bulbs during a great part of the day. At 3.20 the Stevenson stand on ground gave $93^{\circ}\cdot3$ dry, $69^{\circ}\cdot4$ wet bulb; notwithstanding these differences, the dew point temperature obtained direct by my hygrometer at three separate times during the day was not lower than from 59° to 60° .

At 5.50 the temperature on ground stand and that at top of tower was nearly equal 86° . At 8.10 the Glaisher stand gave $68^{\circ}\cdot6$ dry, 64° wet bulb; that at top of tower 74° dry, $65^{\circ}\cdot2$ wet; this difference was not all due to radiation from the ground upon the open face of the stand, as on striking a light to look at the thermometers in the Stevenson's stand close by, the temperatures were nearly the same. The amount of evaporation taken from a vessel 21 inches in diameter (kept nearly full to the brim), and surrounded by other water, was from 9.10 a.m. to 7 p.m. $0\cdot174$ in., from 7 p.m. to 9 a.m. this morning $0\cdot084$ in.; total during the 24 hours $0\cdot258$ in. This is a large amount, but it was exceeded five times during the month of July last.

Yours truly,

G. DINES.

Woodside, Walton-on-Thames, August 14th, 1876.

P.S.—The maximum temperature of to-day has been $91^{\circ}\cdot3$ from the Glaisher stand upon the ground, $87^{\circ}\cdot9$ at the top of tower.

To the Editor of the Meteorological Magazine.

SIR,—As supplementing my letter of last week I send you the following.

My maximum thermometer is suspended from strips of wood two inches below the back-board of a Glaisher stand, so that the bulb is fully exposed on all sides to the natural flow of the atmosphere. I find this thermometer to read on a hot day from 1 to $1\frac{1}{2}$ degrees lower than another maximum thermometer placed on a continuation of the same narrow strips, but higher up on the stand.

1876.		Max. temp.		Min. temp.		Range of temp.		Difference between dry and wet bulbs, at 3 p.m.
Aug. 12	...	$80^{\circ}\cdot0$	...	$48^{\circ}\cdot6$	...	$31^{\circ}\cdot4$	...	$14^{\circ}\cdot3$
„ 13	...	$93^{\circ}\cdot6$	...	$56^{\circ}\cdot3$	...	$37^{\circ}\cdot3$	...	$24^{\circ}\cdot8$
„ 14	...	$90^{\circ}\cdot8$	...	$56^{\circ}\cdot7$	...	$34^{\circ}\cdot1$	...	$20^{\circ}\cdot0$
„ 15	...	$89^{\circ}\cdot9$	...	$59^{\circ}\cdot0$	...	$30^{\circ}\cdot9$	...	$18^{\circ}\cdot2$
„ 16	...	$83^{\circ}\cdot9$	...	$61^{\circ}\cdot0$	...	$22^{\circ}\cdot9$	...	$11^{\circ}\cdot9$
„ 17	...	$85^{\circ}\cdot3$	...	$59^{\circ}\cdot1$	...	$26^{\circ}\cdot2$	...	$12^{\circ}\cdot9$

The means of the four highest temperatures of the past four summers here have been respectively:—

1873 - $85^{\circ}\cdot7$... 1874 - $87^{\circ}\cdot0$... 1875 - $81^{\circ}\cdot9$... 1876 - $91^{\circ}\cdot2$

The extreme temperatures:—

1873 - $87^{\circ}\cdot0$... 1874 - $88^{\circ}\cdot2$... 1875 - $84^{\circ}\cdot0$... 1876 - $93^{\circ}\cdot6$

No one can regret more than myself that it should be necessary to

give so many details as I have done in these two letters respecting the exposure of my thermometers ; but still I think I ought to add that the thermometer-stand during the above years has remained in the same open situation, and the thermometers on it in precisely the same positions.

I sincerely hope that the day is not far distant when our shade temperature will be, for all practical purposes, as strictly comparable as so many of our rainfall observations are at the present time. I am well aware of what the Meteorological Society is doing in this direction ; but this, with the important exception of setting us a good example, will but little affect private observers generally.

I remain, Sir, yours truly,

EDWD. MAWLEY.

Addiscombe, Croydon, Sept. 7th, 1876.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall here for rather more than 5 hours (9 a.m. to 2.30 p.m., during which time there was scarcely a cessation,) was simply excessive, viz., 1.17 inches. I measured it just now : the amount in the gauge this morning, at 9 a.m., was 0.45 in. There was a slight thunderstorm here last evening, lasting on and off up to about 1.30 a.m. The rain this morning came up quietly in first instance from E.S.E. and S.E., then wind veered S.S.E. and S.W. ; at about 1.30 p.m. it veered W.S.W., and then W. ; afternoon being fine, as also this evening, but now wind is S.E. again, with a rising barometer.

The enclosed memo. is our rainfall and temperature at various times during the present month.—Yours truly,

WM. J. HARRIS, F.M.S.

13, Marine Parade, Worthing, August 20th, 1876.

Date.	9 a.m.			9 p.m.			
	Rainfall	Dry and Wet Bulb.		Dry and Wet Bulb.		Max. in Shade.	Max. in Sun.†
August 2 ..	0.02	...	...	...	..	...	...
4 ..	0.94	...	...	...	...	...	...
9 ...	...	71°·1	66°·2	63°·5	61°·7	76°·0	126°·0
10 ...	...	69·9	64·7	62·0	58·9	80·0	132·0
11 ...	...	65·7	62·2	61·9	58·8	71·0	121·0
12 ...	...	74·0	66·7	68·6	65·0	79·0	128·6
13 ...	...	74·0	69·0	66·3	64·9	82·1	126·0
14 ...	...	70·7	67·7	66·5	64·3	74·3	121·3
15 ...	...	70·2	67·0	66·7	65·0	...	...
16 ...	...	79·5	70·7	68·0	59·4	78·0	124·3
17 ...	...	76·0	68·5	77·9	70·0	84·0	127·5
18 ...	0.15	...	...	...	...	82·0	123·0
19 ...	0.45	...	...	...	...	79·2	90·0
20 ...	1.17*	...	..	...	...	...	...

* To 9 p.m.

† Black Bulb in vacuo.

To the Editor of the Meteorological Magazine.

SIR,—I append the readings of my thermometers for the nine days from the 9th to the 17th August, the hottest period we have had here for the last six years at least, the nearest approach being in the ten days from the 13th to the 22nd of last month.

My thermometers are four feet from the ground (grass) in a Stevenson screen, and the readings are corrected in accordance with the Kew certificates, the greatest error being $0^{\circ}2$.

It will be seen that the temperature was above 80° on seven days, and was highest on the 13th. On that day, at 3 p.m., there was a difference of more than 20° between the dry and the wet bulb, which stood respectively at $88^{\circ}4$, and $68^{\circ}1$.

The highest temperature recorded here during the five previous years was $88^{\circ}5$ in July, 1874.—Yours truly,

JOHN HOPKINSON.

Watford, 23rd August, 1876.

			9 a.m.		9 p.m.	
			Dry.	Wet.	Max.	Min.
Aug.	9	...	$72^{\circ}0$	$65^{\circ}3$	$82^{\circ}5$	$52^{\circ}9$
	10	...	$64^{\circ}1$	$57^{\circ}7$	$78^{\circ}2$	$54^{\circ}8$
	11	...	$63^{\circ}2$	$57^{\circ}4$	$76^{\circ}0$	$44^{\circ}7$
	12	...	$69^{\circ}0$	$61^{\circ}4$	$81^{\circ}6$	$51^{\circ}2$
	13	...	$78^{\circ}4$	$66^{\circ}6$	$89^{\circ}0$	$59^{\circ}6$
	14	...	$74^{\circ}5$	$66^{\circ}7$	$86^{\circ}8$	$55^{\circ}5$
	15	...	$74^{\circ}9$	$62^{\circ}3$	$85^{\circ}9$	$59^{\circ}9$
	16	...	$74^{\circ}3$	$68^{\circ}0$	$81^{\circ}7$	$61^{\circ}3$
	17	...	$64^{\circ}5$	$59^{\circ}7$	$85^{\circ}8$	$55^{\circ}6$

P.S.—During the last eight days, from the 31st August to the 7th September, 3.05 inches of rain have fallen here. On the night of the 5th, in a few hours, 1.13 inches fell.

J. H.

8th September.

To the Editor of the Meteorological Magazine.

SIR,—I did not think it worth while sending you any account of the high temperatures we had here in July, as they were nothing very extraordinary, 87° being the highest on the 16th; but for this month you may, perhaps, think it worth recording, as on two days it was the highest I have ever recorded—Sunday, the 13th, especially. The highest record I have at 9 a.m. is 78° , but on the above-named Sunday it was 83° . I took the dry and wet bulb thermometers every three hours as under:—

		9 a.m.		Noon.		3 p.m.		6 p.m.		9 p.m.	
		Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
13th	...	$83^{\circ}0$	$71^{\circ}0$	$90^{\circ}0$	$75^{\circ}0$	$89^{\circ}0$	$71^{\circ}5$	$82^{\circ}0$	$70^{\circ}0$	$66^{\circ}0$	$62^{\circ}5$
14th	...	$80^{\circ}0$	$70^{\circ}0$	$89^{\circ}8$	$72^{\circ}0$	$87^{\circ}3$	$71^{\circ}7$	$81^{\circ}0$	$71^{\circ}0$	$68^{\circ}0$	$62^{\circ}5$
15th	...	$78^{\circ}0$	$70^{\circ}0$	$87^{\circ}0$	$72^{\circ}5$	...	...	...	...	...	...

The maximum for these days were 13th, $90^{\circ}5$; 14th, $91^{\circ}8$; 15th, $87^{\circ}7$; 16th, $86^{\circ}0$; 17th, $88^{\circ}3$; 18th, $81^{\circ}3$. A strong breeze arose

just before noon on the 13th, which kept the temp. down a little, as it was below 90° from noon till about 2 p.m.

In contrast to these high temperatures, we have the last few days had it very cold, the 25th being only 60°·5 max., and min. 40°·6 ; on 26th, max. 62°·6, min. 34°·5 ; on grass only 30°.

I remain, Sir, your obedient servant,

J. BRYAN.

Audley End, August 28th, 1876.

To the Editor of the Meteorological Magazine.

SIR,—The greatest day's rainfall on record here, occurred during heavy thunderstorms on Saturday, August 19th, 1876.

The quantity measured was 3·570 inches, which fell as follows :—

Aug. 19th.	Between 2 and 3.30 p.m.	...	1·530 in.
"	" 6.45 and 9 p.m.	...	0·643 "
"	" 9 and 10 p.m.	...	1·077 "
"	" 10 p.m. and 9 a.m. (20th)	...	0·320 "
			3·570 in.

This is considerably in excess of the fall on July 14th, 1875, when 3 inches were measured in some parts of Bristol, and is greater than the aggregate amount for the preceding three months :—

In May	the fall was	0·286 inch.
In June	"	1·212 "
In July	"	1·473 "

or slightly less than 3 inches.

Between 2 and 3.30 p.m., and 9 and 10 p.m., the rain fell in torrents, and at a rate exceeding an inch per hour. The afternoon storm was very partial to this locality ; that in the evening was, however, very general over a wide area. On the same day, at Westbury-on-Trym, the rainfall was 3·00 in., at Cotham 2·45 in., at Clifton 2·01 in., and at Backwell 1·77 in. ; "of which 1·31 in. fell in the afternoon in a very short time."—Yours, &c.,

WILLIAM F. DENNING, F.M.S.

Tyndale House, Ashley Down, Bristol, August 20th, 1876.

To the Editor of the Meteorological Magazine.

SIR,—In this locality the maximum temperature of many of the days in July and August has been so high that it may be interesting to place them on record.

Before the 12th of July the temperature was rather low, it then suddenly increased, and the following were the maximum temperatures of the succeeding days, as registered by thermometers, made by

Casella, tested at the Kew Observatory, and enclosed in a stand similar to the one at Kew :—

July 12th, 76°·0	July 17th, 77°·5	July 22nd, 85°·2
13th, 86°·4	18th, 80°·5	23rd, 75°·2
14th, 91°·5	19th, 77°·2	24th, 76°·8
15th, 93°·0	20th, 78°·7	25th, 84°·6
16th, 92°·5	21st, 86°·7	26th, 77°·4

From the 26th July till the 7th of August, the maximum temperature did not reach 75° on any day, but another hot period then set in as follows :—

Aug. 7th, 78°·7	Aug. 11th, 81°·8	Aug. 15th, 84°·5
8th, 80°·7	12th, 83°·2	16th, 86°·5
9th, 83°·8	13th, 92°·5	17th, 86°·0
10th, 75°·0	14th, 90°·0	

On the 12th, 13th, 14th and 15th July the sky was nearly cloudless, and the air very dry, but rather hazy on the 15th. After 12 noon of the 16th, small lofty yellow cumuli appeared above the haze, in the western part of the sky, increasing and gradually covering the sky. At 2 p.m. the thermometers stood at 92°·5, the max. of the day, and very distant T was heard. At half-past 2 p.m. T was frequent in the N.N.W., where the sky was covered with very lofty dark shaded cirrus clouds, and in other places with masses of cumuli. At 3 p.m. the thermometers had fallen to 89°, and masses of lofty hazy cumuli of different colours filled the sky, generally moving towards the N.N.W. where the T was loud, and the L visible. After half-past 3 p.m., the L and T were very frequent, and the cumulous clouds had increased in size and grandeur all round, piled in vast masses, and reflecting different colours ; but the focus of the storm appeared to be in the N.N.W., with frequent flashes of L passing across the sky, and often overhead at a height of three or four miles. About 4.45 p.m., it became dark, and portions of the sky were covered with masses of dark festooned clouds, hanging like soot bags and rapidly changing their forms.

From 5 till 6 p.m. the flashes of L were very frequent, and the peals of T loud and almost continuous, whilst the R fell steadily at intervals till 6.30 p.m., when it ceased, and the storm appeared to pass off to the East. The fall of R here was only 0·245, and it did not appear to be much greater for a distance of many miles around us.

Before noon on the following day the river Teme, which flows through our valley, had risen about two feet, and had assumed the colour and consistence of thin mustard, and it did not become clear again for more than a week after.

It appears from the papers, that the storm which produced this freshet fell in and around the parish of Munslow, through which the Corve brook flows and falls into the Teme at Ludlow. It is said to have commenced about 1.30 p.m., and to have ended about 5.30 p.m., and was most destructive. Hailstones fell in vast quantities and of great size, many of them as large as hen's eggs, destroying nearly all

the glass in the windows and conservatories of Millichope Hall, and of the houses in the village ; and the fall of R was so terrific for nearly an hour after, that the water rushed through the houses, and the Corve brook soon covered the meadows, sweeping away the hay and destroying the crops of grass. The trees were stripped of their leaves, and the grain crops destroyed by the hail, whilst the soil of many fields planted with turnips was swept into the Corve. Three days after the storm hailstones were found lying in heaps where they had been swept together by the floods. Many sheep were drowned, and cattle killed by the L, and it was estimated that the damage done would amount to several thousands of pounds.

This storm appears to have been nearly stationary, and the great fall of hail does not appear to have extended over a space more than about three miles in diameter.

Munslow is about 17 miles in a straight line to the N.N.W. of this place. Beyond it at a distance of about 3 miles flows the Onny in a parallel course to the Corve, falling into the Teme above Ludlow ; and on this side, at a distance of about 4 miles, are the sources of the Letwyche, which falls into the Teme below Ludlow, and neither of these streams were discoloured by the rain.

I am, Sir, yours truly,

THOS. HENRY DAVIS.

Orleton, near Tenbury, August 29th, 1876.

A SUNSET.

To the Editor of the Meteorological Magazine.

SIR,—I cannot refrain from attempting to give you such an idea as weak words are able to convey, of the gorgeous, the glorious spectacle which the heavens presented to our astonished gaze here for about an hour last evening. A few minutes after sunset, I was sitting on a garden lawn on a seat looking towards the East ; the sky and clouds had assumed a pearly grey, and I was lazily watching the “gradual dusky veil” of evening being drawn over the distant Cotswold range, when I became aware of a faint rosy tint, which began to appear in the sky just over Stinchcombe Hill. Could it be the moon ? While I was vaguely wondering, the rapid increase of the roseate hues inspired me for a moment with the awful idea that some strange abnormal appearance of a sun-rise was about to present itself, though the orb of day had so recently disappeared beyond the western horizon. Turning my head, however, to speak to a friend who was approaching, I perceived that this mimic rosy dawn was but the reflection of the far more wonderful spectacle, which was gradually unfolding itself in the western sky. Large masses of cloud, which had put on the sober tints of evening, and other lighter fleeces of vapour, which were beginning to lose themselves in the dusky blue, were becoming rapidly changed to burning gold : gradually closing up in the west, but with intervening spaces of clear deep blue towards the zenith, the whole

western heavens soon presented the appearance of a huge vault, whose cavernous roof was being brilliantly and awfully illuminated by some enormous volcanic conflagration, the source of which was far below the horizon. Changing its appearance every moment, the more prominent parts seemed burnished to an intolerable radiance, while the more remote depths were of a lurid coppery hue, suggesting the idea of an intense sub-incandescent heat, which the close heavy temperature of the air only served to heighten.

And now a new wonder appeared; in the South-Eastern sky, just opposite the lately setting sun, but with its summit reaching almost to the zenith, appeared a rainbow! On a background of crimson and purple cloud, it formed three-fourths of a complete circle, with a diameter of about forty degrees, but the usual colours were strangely absent, shewing that it was not the familiar bow of Iris that we were gazing upon. Its predominant hue was a deep crimson, brightening to a faint line of orange on its inner side, while its outer circumference shaded off into deep purple and black. While we were contemplating this wonderful halo, the gorgeous panorama in the West had undergone a change. Gradually breaking up into distinct masses, the lately burning metallic vault now shewed large rifts, through which the sky overhead appeared of a deep transparent blue, while the clouds were of the purest gold, being permeated through and through with the radiance from the departed sun; lower down they seemed to have retired to incalculable distances, and to have changed their shape to long purple and crimson ridges, still, however, lighted up on their under sides by the brilliance from below. The sky intervals were of pale transparent gold, gradually melting into evening's own pearly grey towards the north, while in the south they became veiled and lost in purple clouds. Slowly the glorious hues faded away, and thus closed the most unearthly and wonderful spectacle it has ever been my fortune to witness, and which will ever retain a place in my remembrance.—Yours, &c.,

J. H. C.

Berkeley, July 19th, 1876.

MISCELLANEOUS.

To the Editor of the Meteorological Magazine.

SIR,—As I think the following occurrences should be chronicled, I send you short accounts for insertion in the *Meteorological Magazine*, should you be of my opinion.

At 8.50, on the evening of the 17th instant, I was told that a solar halo was visible. Naturally I rather doubted the assertion, but on going out I found a perfectly distinct segment of a large circle of white light, stretching across the clear northern sky. It was undoubtedly a halo. I made a sketch at the time, and as the stars were shining brightly, I was able to ascertain its exact position. The circle exactly

passed over β Ursae Majoris, the apparent highest point being rather to the right, and a little to the north of that star, close to ν of the same constellation. I found that the sun's position for the day exactly suited as the centre. I then took the measurement of the circle, i.e., from the highest point to the sun's position, and found it to be 46° . Afterwards I referred to a book, and found the diameter of the large solar halo was also exactly 92° . I was not aware of this before. So I think there cannot be the least doubt but that it was a portion of a solar halo of the unusual size, and seen at a most unusual hour. At 9 o'clock it had disappeared. Anyone can verify my deductions by noting the positions on a celestial globe.

On the same day the temperature rose in a very abnormal manner. The morning was tolerably cool, being at 9 a.m. $68^\circ.8$ against 76° the previous day, but during the morning the temperature rapidly rose, the maximum being $84^\circ.3$. At 7 p.m. it had fallen to 76° , but at 9 o'clock the E.N.E. wind having freshened to force 6, the temperature again rose to $79^\circ.7$, and before ten it had been up to $80^\circ.6$, but by that hour it had fallen to 78° .

I now come to the third curious point. On the following morning I found the index of my grass thermometer above the spirit. I thought the occurrence rather remarkable as it is one of Hicks's best, but still more so when a friend who lives about two miles off came to me in tribulation to say his grass thermometer was entirely out of order. I found not only the index above the spirit, but the spirit itself in several pieces. This was likewise a good thermometer, made by Horne and Thornthwaite. I asked him to let me know on what day it became in that condition. On referring to his book he told me it was on the morning of the 18th. Both thermometers were found in their proper positions. Now I think this a very remarkable coincidence, and should be glad to have an explanation of the circumstance, and also to hear whether any others were affected in the same way. I can only account for it by supposing that there was a very rapid fall of temperature.

Your readers may also, perhaps, care to hear that on the 16th I cooked an egg by the heat of the sun alone. It was in a tumbler of water, which was placed in a box, lined with black felt, and well surrounded by wraps of various kinds. It was protected from the wind, and the box was covered with two thicknesses of glass. The thermometer rose to 210° , but unfortunately at that time the wind began to blow rather fresh from the East, and the temperature fell. On breaking the shell the yolk was found done hard, and the white almost but not quite set. I first tried on the previous day, but the heat of the sun cracked the inner sheet of thick glass in a very curious manner, the crack being in a kind of undulating zigzag from side to side.—I am, Sir, faithfully yours,

ALEX. E. MURRAY.

Hastings, 30th August, 1876.

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SUPPLEMENTARY TABLE OF RAINFALL IN AUG., 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	1·77	Llanfrechfa	6·02
Hailsham .....	...	Castle Malgwyn	3·56
Andover	1·71	Heyope	3·45
Strathfield Turgiss	2·77	Rhug, Corwen	4·22
Addington Manor	2·37	Port Madoc	3·92
Oxford	2·58	Melrose	4·02
Cambridge	1·53	Cessnock, Glasgow	4·64
Sheering	2·10	Gruinart	6·17
Ipswich	1·22	Keith	2·19
Diss	1·42	Strathconan	3·04
Swaffham	2·25	Springfield, Tain	1·13
Compton Bassett	3·96	Skibbereen	2·26
Dartmoor	6·98	Glenville, Fermoy	4·11
Teignmouth	2·97	Tralee	3·60
Torrington (Langtree) ..	3·45	Newcastle W., Limerick ..	3·82
Trevarrick, St. Austell. ..	4·88	Kilrush	1·58
Taunton	2·49	Kilkenny	3·73
Bristol .....	...	Kilsallaghan	3·13
Sansaw	2·73	Twyford, Athlone	4·56
Cheadle	2·42	Ballinasloe	4·33
Ashby-de-la-Zouch	2·66	Kylemore	7·45
Coston, Melton Mowbray ..	2·04	Bangor	4·69
Bucknall	1·58	Carrick on Shannon	3·70
Walton, Liverpool	3·52	Rockcorry	3·42
Broughton-in-Furness ..	4·61	Warrenpoint	4·19
Stanley, Wakefield	1·77	Bushmills	3·78
Gainford	2·21	Buncrana	3·86
Shap	4·01		

AUGUST, 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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.						
				Dpth.	Date.	Deg.		Date.	Deg.	Date.				
I.	Camden Town	inches	inches.	in.										
II.	Maidstone (Linton Park).....	1.79	— .85	.42	4	12	92.3	13	43.8	26	0	0		
III.	Selborne (The Wakes).....	2.52	— .19	.54	31	14	91.0	8.17	47.0	25	...	...
IV.	Hitchen	3.71	+ .53	.87	4	10	85.0	13	39.3	25	0	0		
V.	Banbury	1.39	— .96	.32	4	15	81.0	14*	38.0	24	...	...
VI.	Bury St. Edmunds (Culford).....	3.18	+ 1.05	.59	30	14	87.0	13	38.0	25	0	...		
VII.	Norwich (Sprowston).....	1.71	— .73	.80	31	13	87.0	14	35.0	25	0	1		
VIII.	Bridport .....	...	...	...	...	...	...	...	...	...	...	...
IX.	Barnstaple.....	2.99	+ .40	1.34	4	11	86.0	17	43.0	25	...	...
X.	Bodmin	2.74	— 1.45	.65	30	13	89.0	14	51.0	1.26	...	...
XI.	Cirencester	5.44	+ 1.58	1.24	30	14	76.0	18	45.0	31	0	0		
XII.	Shifnal (Haughton Hall)	3.00	+ .16	.58	19	9	...	...	...	...	...	...
XIII.	Tenbury (Orleton)	2.31	— .56	.69	31	16	79.0	13+	41.0	31	0	0		
XIV.	Leicester (Belmont Villas)	1.99	— .89	.76	31	14	92.5	13	35.2	25	0	0		
XV.	Boston	2.10	...	.45	28	12	95.5	13	37.8	25	...	...
XVI.	Grimsby (Killingholme)	1.74	— .55	.41	31	12	89.0	13	42.0	25	0	...		
XVII.	Mansfield	1.85	...	.41	28	12	79.0	9	44.0	25§	0	...		
XVIII.	Manchester	1.48	...	.59	2	15	...	...	...	...	...	...
XIX.	York	3.07	— .43	...	...	17	87.0	13+	37.0	25	0	0		
XX.	Skipton (Arncliffe)	1.57	— 1.14	.56	2	8	86.0	13	40.0	23	...	...
XXI.	North Shields	5.10	— .84	1.80	2	15	83.0	18	35.0	23	0	...		
XXII.	Borrowdale (Seathwaite).....	1.28	— 1.57	.48	2	10	71.8	9	39.6	25	0	0		
XXIII.	Cardiff (Ely)	9.77	— 4.31	3.36	2	12	...	...	...	...	...	...
XXIV.	Haverfordwest .....	...	...	...	...	...	...	...	...	...	...	...
XXV.	Machynlleth	4.63	— .25	1.80	2	12	81.6	17	42.0	3	...	...
XXVI.	Llandudno	5.69	...	1.26	2	17	89.5	13	28.0	24	3	...		
XXVII.	Dumfries (Crichton Asylum)	2.75	— 1.07	.91	31	13	85.8	16	48.6	31	...	...
XXVIII.	Hawick (Silverbut Hall)	3.87	+ .22	1.80	2	10	89.8	15	36.9	25	0	0		
XXIX.	Kilmarnock (Annanhill).....	4.34	...	1.47	30	11	...	...	...	...	...	...
XXX.	Castle Toward	4.82	...	1.52	30	13	84.7	15	33.4	25	0	1		
XXXI.	Mull (Quinish)	3.98	— 2.32	1.21	3	13	83.0	14	...	...	...	...
XXXII.	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Braemar	2.74	...	1.57	2	8	...	...	...	...	...	...
XXXV.	Aberdeen	2.43	— 1.41	.96	2	19	85.0	14	39.3	1	0	1		
XXXVI.	Loch Broom	1.48	...	.42	2	14	75.2	11	41.9	28	0	0		
XXXVII.	Portree	2.63	...	.47	3	17	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	4.37	— 3.08	.82	8	18	...	...	...	...	...	...
XXXIX.	Helmsdale	1.50	— 1.75	.46	28	15	79.9	19	41.7	1	0	0		
XL.	Sandwick	1.76	...	.37	2	17	...	...	...	...	...	...
XLI.	Caherciveen Darrynane Abbey	2.56	— 1.15	.38	26	17	69.0	16	41.8	28	0	0		
XLII.	Cork	5.64	...	.90	2	23	...	...	...	...	...	...
XLIII.	Waterford	2.94	...	1.10	2	9	...	...	...	...	...	...
XLIV.	Killaloe	3.49	— .46	1.33	2	10	76.0	20	46.0	31	...	...
XLV.	Portarlington	4.55	— .38	1.33	2	16	85.0	13	40.0	2||	...	...
XLVI.	Monkstown, Dublin	3.46	— 1.04	1.58	3	17	80.5	13	44.0	30	0	...		
XLVII.	Galway	2.52	— .69	1.23	2	9	...	...	...	...	...	...
XLVIII.	Ballyshannon	3.07	...	1.06	1	12	89.0	13	39.0	29	0	...		
XLIX.	Waringstown	3.63	...	.95	28	15	...	...	...	...	...	...
L.	Edenfel (Omagh)	3.17	...	1.13	2	16	86.0	14	42.0	24	0	0		
		3.75	...	1.49	2	17	79.0	15	38.0	1	0	0		

* And 15.

+ 16.

‡ 14.

§ 31.

|| 24 & 25.

+ Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON AUGUST.

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.—First half of the month very hot and dry, but after the 18th there were more showers, and scarcely any thunder during the month. Bar. generally high, although there were frequent changes of wind. On the whole it has been a fine and warm month, and the useful rains that fell towards the end of it were much wanted in many ways, not the least being to the dry dusty roads, which, as well as the thirsty vegetation, benefited much by the moisture.

SELBORNE.—5th, temp. rose 5° after 4 p.m.; 12th, dense fog early; 16th, T 2 to 4 p.m.; 18th and 20th, T; 19th, dense fog, heavy TS at night. S.W. winds prevailing great part of the month. Crops generally improved, and well harvested. Many persons suffering from sunstroke during the bright hot weather after the 10th of the month.

BANBURY.—Harvest nearly finished at the end of the month. T and L on 15th and 16th.

CULFORD.—A month of very dry warm weather, for although the rainfall amounted to 1.71, a large portion of it fell on the last day. The highest temp., 87° , was that reached on the 14th. A sudden and remarkable depression of temp. took place on the 25th, when the max. temp. was only 59° , and the min. 35° , while the grass in low situations was slightly crisp with frost early in the morning of the following day. The month was remarkable for an entire absence of Polar or Easterly winds. Mean temp., $61^{\circ}8$. T on 21st, and during the night of the 31st.

BODMIN.—Mean. Temp., 66° . The rainfall (5.44) 2.20 above the average of 27 years. The springs lower than they have been known for many years.

SHIFNAL.—Great and sudden changes of temp. during the month. It opened with cold (42° at night, and 62° at day), with R on 4th. On the 7th heat returned, lasting to the 22nd, on 13th and 16th reaching 79° in the shade; on 22nd it became suddenly cold again, with a change of wind from N.E. to N. and N.W., and so continued to the end of the month, R falling daily (with the exception of the 29th) from 23rd to 30th, and ending with a fall of .69, accompanied with high wind, veering from S.W. to N.W. on 31st. The R coming with the cold did little damage to the crops of grain, which are nearly an average, and that of swedes and mangold wurtzel abundant, owing to the timely R falls of July; mushrooms showing numerously (last year not one.)

ORLETON.—The first six days were cool and rather cloudy, with frequent slight scuds of rain; the weather then became bright and hot. On the 13th the heat was very great, with a cloudless sky, the ther. rising to $92^{\circ}5$ in the shade, which is the max. I have registered in August during the last 50 years. On the 14th also the ther. rose to 90° , and the temp. continued high till the 22nd, when the weather became cold, with rough winds, and the max. temp. on the 31st only reached $54^{\circ}2$, accompanied by heavy falls of R. On 18th and 19th there were heavy storms of T and L, but not near; T was heard on 4th and 30th; L seen on 15th, 17th and 30th. The great heat and continued drought have proved very injurious to the grass and roots, and crops of beans. The mean temp. of the month was about $0^{\circ}5$ higher than the average.

LEICESTER.—Very favourable weather for harvest operations, with the exception of the last few days. The max. on 13th was $95^{\circ}5$; the max. exceeded 80° on ten days in this month, ten days in July, and three in June. Max. on 24th only $59^{\circ}8$; mean. of month, $63^{\circ}3$. Much T and L on evening of 15th.

GRIMSBY.—A very fine harvest month; corn crops good in quality but not abundant in quantity; potatoes an excellent crop, and free from disease at present. The rain at the end of the month was much needed for the root crops. T, L, and R 11 a.m. till noon on 1st. Harvest commenced in a few places on the 7th, general on the 14th. Great fall of temp. at night on 22nd.

MANCHESTER.—22nd, fine large solar halo.

ARNCLIFFE.—The finest summer month that we have had for many years ; unusually hot and cloudless between 11th and 20th.

NORTH SHIELDS.—T on 1st and 2nd, and L on 26th.

SEATHWAITE.—T on 24th, and TS on 31st ; only three days on which the fall exceeded 1 inch, but there were eight days (out of the 12 on which rain fell) on which half an inch or more was measured ; on the 2nd, 3·36 fell.

WALES.

HAVERFORDWEST.—Wet during 1st, 3rd, and last weeks. From 4th to 21st the weather was magnificent and the heat very great. Severe thunderstorms on 17th and 19th, L very vivid ; after the 19th the temp. fell very suddenly and the weather was broken and autumnal to the end of the month.

MACHYNLLETH.—A very wet month, stormy at the beginning and ending very cold nights 22nd to 25th inclusive ; 15th, T at a distance about 7 p.m. ; 17th, L in the evening ; 20th, distant T, slight R but not enough to measure ; 28th, rough wind and very stormy ; 30th, very stormy, T and L at night.

LLANDUDNO.—Weather variable, and pleasantly cool till the 6th, from thence warm and fine again, cooler on 22nd, and broken weather from the 24th to the end of the month, the last day being wet, stormy, and cold. Barley harvest begun on 7th. Sheet L in the evening of the 5th ; L in the night of 16th ; T shower at 1.30 p.m. on 24th ; TS between 4 and 5 p.m. on 30th.

SCOTLAND.

DUMFRIES.—A fine dry month, although the rainfall is above the average, but half of it fell on one day, the 2nd. The middle of the month was dry ; mean temp. 58°·5, slightly below that of last year. T was heard twice, and the only high winds were at the beginning and end of the month.

HAWICK.—Between 6 p.m. on 30th and 6 p.m. on the following day 2·68 in. of rain fell with T, the heaviest fall in 24 hours which has ever been recorded here during the 11 years the gauge has been in use. The month has been a very hot one, and mildew has been such as to kill even the groundsel weeds. The heavy rains on the last two days will be very beneficial.

ANNANHILL.—Barometric pressure less than last month ; two heavy depressions, one on 3rd and one on 30th. A gale on 3rd and TS on 30th, with max. fall of month (1·52) ; 2·67 of the total fall (4·82) fell during the last five days of the month. Green crops promise well and potatoes show no disease as yet. Harvest operations commenced, but the rain at the close of the month retarded them. The death rate 24·5 per 1000, the number of deaths being 49 ; principal causes, consumption, bronchitis, and diarrhœa.

BRAEMAR.—A very fine warm month.

ABERDEEN.—Bar. pressure and rain below the average, temp. slightly above it. A month of dry and rather quiet weather, with great heat in the middle of it, while, by contrast, the latter part seemed cold.

LOCHEBOOM.—Extremes of temp. were a distinguishing feature of the month, and extreme heat succeeding T is not usual here, yet we had T on the 10th, followed by heat on the following day and continuing till the 21st, after which time the weather was wet and cold. The rapidity with which the crops ripened after the heat was astonishing. Hands could not be got to cut it as soon as it was ripe. Crops light, potatoes sound (as yet), hay scarce, turnips good, new grass plentiful ; stock in fair condition.

PORTREE.—The first nine days were wet and stormy, thence to the end mild ; from 9th to 22nd no rain fell and during this period the hay crop was secured in fine condition. The potato blight has appeared on some farms, the fields are already quite black.

CULLODEN.—High wind on night of 10th from S.S.W., to S.W. ; fogs on 13th, 15th, 16th, and 21st. Distant T at 1.30 p.m. on 15th ; heavy dew on night of 19th ; very hot on 18th, but with a pleasant breeze. Max. temp. of month (79°·9) on 19th.

SANDWICK.—The first ten days were wet and stormy with a few exceptions, the next ten were beautiful and not a drop of rain fell, the rest of the month was generally cold and wet, with northerly winds; auroræ on 4 nights; 3rd, wind 40 to 45 miles an hour, from 7 to 11 a.m.; 4th, wind 40 to 45 miles an hour from 2 a.m. to 6 p.m.

IRELAND.

DARRYNANE.—A wet ungenial month, with a few very fine days. Fresh gale from N.W. on 30th and 31st. Potato blight appeared early in the month, but has not done much injury to the tubers.

WATERFORD.—17th, L and T from 4 to 5 a.m., and very vivid L with T from 7 to 9 p.m. Such an exhibition of L as few inhabitants ever saw in Waterford.

KILLALOE.—Temperature during early part of month generally high (day and night). On the morning of 17th a violent storm of T and L set in, and continued at intervals all day. Vegetation very good.

MONKSTOWN.—A warm fine month with a few cool days. A severe TS occurred on evening of 17th, commencing about 9 p.m., and lasting till between 1 and 2 a.m. on 18th; L very vivid.

BALLYSHANNON.—The month has been fine and very favourable for the ripening of crops. Rainfall more than August, 1875, by .03. No appearance of potato disease in this locality.

WARINGTOWN.—Warm and fine, though there were two heavy gales. Heavy TS on 17th.

EDENFEL, OMAGH.—The month commenced harsh, cold, and inclement, but from 6th to 24th there followed a magnificent spell of hot summer weather, rescuing the cereals from a condition of jeopardy and giving promise of abundance. For the first time during 12 years the rainfall exceeded an inch on two days in the month, viz., 2nd 1.49, the max. fall of the month, and 30th, when 1.09 fell in little more than 2 hours.

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THE COWES STORM.

ALTHOUGH it has not been, and will not be, possible for us to examine personally, or by deputy, the track of this storm, we think that it would be inappropriate to allow it to pass without notice in these pages. We hope, however, that some one will come forward and prepare a complete record like Mr. Rowell's narrative of that at Calne;* that by Mr. Beesley and ourselves of the Newbottle whirlwind;† or that which we gave of the storm at Hitchin.‡ We incline to the belief that this Cowes storm was more remarkable than either of those above-mentioned, and will well repay any one who will devote a week or ten days to its examination. Meanwhile, that no time may be lost, we shall be glad to receive any notes, letters, or newspaper cuttings referring to it, and to forward them to whosoever intimates his intention to work up the subject.

Our Ryde correspondent (Mr. R. Taylor), after personal inspection of the state of Cowes, sent us the account which we append, and reported that it might be accepted as correct. All other statements which we have yet seen are confirmatory, but nearly all add some facts which are useful. As we are not attempting to compile *the* history of the storm, we quote only one other record, viz., that from *The Times* of what occurred N.E. of Fareham.

We have been strongly tempted to correct the grammar and language of the following report, but have decided upon reprinting it *verbatim*, merely adding a few stops.

DISASTROUS WHIRLWIND AT COWES.

A terrific whirlwind passed over Cowes early on Thursday morning, with most alarming and disastrous effects. It was in character akin to the cyclone of the tropics, and seldom have the ravages of a storm been more severely felt in this country. From all that can be gathered it originated in the neighbourhood of Brixton, at 7.15 a.m., one of the first to suffer from it being Miss Arnold, of Wyeate-court, whose outbuildings were stated to have been demolished. Thence it appears to have whirled across country by Tinkers-lane, and by way of Mill-hill into

* A Lecture on the Storm in Wiltshire, Dec. 30, 1859, read at a meeting of the British Meteorological Society, by G. A. Rowell. Printed at the request of the Society, and published by the Author, Alfred-street, St. Giles, Oxford, 1860.

† Met. Mag. Vol. VIII., pp. 150-154, 167-171.

‡ Met. Mag. Vol. X., pp. 83-88.

the town of Cowes, its route being marked throughout by a continuous line of wreckage. Of course the individual sensations produced by the phenomenon vary, but it is generally agreed that the whirlwind was heralded or accompanied by a lurid glare of electric light, and its appearance is described as a small spiral cloud, which blasted everything as it swept by. In most cases people had a few minutes' warning of it, from the rushing noise of its progress, and there was a feeling at the same time that something dreadful and unnatural was about to happen. Those who had observed the mercury were also in some measure prepared by its unusual depression for an extraordinary atmospheric disturbance. The appearance of Cowes shortly after the occurrence was astonishing. The parade, where the whirlwind made its exit from the town, was strewn with articles of furniture and *debris* of all descriptions which had been whisked over the house tops like whisks of straw. What was once the well known Globe Hotel had in a moment become a mere tottering ruin, the front being blown completely in, exposing the bed-rooms, in most of which lay heaps of bricks which had crushed through from the roof and walls. The Globe cottage attached to the hotel was similarly demolished, and in each house goods of all descriptions were demolished and in the wildest confusion. Luckily at this season the hotels are not crowded, but the inmates of the "Globe" had one and all miraculous escapes from death, and in fact only one—a Swedish Captain, who lay asleep in an upper room, was seriously injured. This gentleman's ankle was broken, and he was found almost buried in the *debris* from the wall. Mr. A. Wallace, who was occupying a second floor bed-room, had a marvellous escape, the bed from which he had just risen being buried beneath the rubbish. Major and Mrs. Birch were in a similar predicament, but happily were unhurt. Mr. G. A. Mursell, the landlord, was standing at his front door, when hearing the rushing sound, he stepped back, and as he did so he was terrified to see the front of the house collapse, his first thought after ascertaining that his wife and family were safe, was to rush to the rescue of his lodgers. Outside and around the hotel were other striking evidences of the force of the gust. As for windows, nearly all along the parade were blown in, but none of the houses suffered to anything like the extent of the Globe. At Alberta-cottage the iron railing was twisted, and just opposite the iron lamp post was snapped clean off. Many of the pleasure and fishermen's boats upon the beach were much damaged, several being lifted with the blast from off the ground and then dashed down again. An old fisherman, named James Cork, had his boat turned right over upon him, but was not severely injured. Town End House, Dr. Koffmeister's residence, was, so to speak, dislocated, the side wall being nearly burst out. Eye witnesses with whom we conversed on the parade stated that the whirling in the air of the heavy things dislodged by the whirlwind was one of the most startling sights imaginable, and we have it from good authority that the yacht "Palatine," owned by Lord Wilton, the Commodore of the Royal Yacht Squadron, which was steaming up half-a-mile away in the offing, was strewn with barley blown from the stacks on shore, while a brick from one of the houses of the town, struck the fore-castle deck with great force. In another instance a brick was blown across the harbour, and through a sign-board at East Cowes. Leaving the parade, and passing the much abused pier, constructed by Dr. Ker-net, its pagoda-like buildings now laid level with the flooring, we passed up the High-street, through an avenue of broken windows, Sea View House and the Royal Pier Hotel having suffered particularly. The course of the wind can be unmistakably traced up Sun Hill, which is heaped up with slates and tiles, to the police-station, generally so neat and trim, but now in a sad state of dilapidation, all the windows and part of the walls burst in, and two hundred weight of sheet lead, torn from Mr. Halliday's house opposite, lodged in the front parlour. In the station garden, a fine mulberry tree of some two feet girth has succumbed, and on looking around at Mr. Damant's house, and in other directions we behold broken walls, stripped roofs, and tottering chimneys in all directions. Almost all the windows in the Catholic Chapel were broken. At Gravel Lane we see a slate actually driven half-a-foot deep into a wooden window sill. Coming upon the terminus of the Newport and Cowes railway there is another scene of desolation; the engine-house, a large wooden building,

is wrecked, four heavy carriages are blown over on their side, and the water-tank has overturned and smashed down on top of an engine. Down the Victoria-road the same state of things prevails, the scaffolding and part of the brickwork of the new Baptist Chapel is upset; above that, the parapet wall of the reservoir is knocked over for several hundred feet; and on the right the dwelling of Mr. Maggs is nearly blown down, several houses adjoining having also been in the wars. Mr. Bull and Mr. Thomas, builders, have had their workshops much damaged; and further on, at Egypt Hill, Mr. Saunders, florist, has had his stock heavily touched by the hurricane, and many pounds worth destroyed.

Proceeding into the open country we find a new phase of the affair. Here the storm has had full play unconfined. The havoc wrought, though less dangerous to life, is not a whit the less significant of the war of elements. For a couple of miles across country big trees of long growth are torn up by the roots; fences and hedges are swept ruthlessly away; stacks are overturned; barns are raised; and last, though most important, cottages are unroofed and rendered untenable. At Moor farm, Mrs. Jolliffe has had a fine row of trees destroyed. Broadfield's farm, occupied by Mr. John Davies, is a terrible scene of waste. Here the fields are strewn with the wheat and barley swept from his overturned ricks. The out-buildings of the farm are upset, and unfortunately three men—Leonard Drudge, Isaac Dunford, and George Parsons—were crushed beneath the falling barn. They were rescued as speedily as possible, and their injuries, though serious, are, we are informed, not of a dangerous character. At Place farm, occupied by Mr. Moor, there is a similar state of things, and taking the route of Tinkers-lane, passing several ruined labourers' cottages, the owners thereof pitifully bemoaning their fate, we came upon a summer residence of Mr. Redfern, who was fortunately away with his family when the whirlwind seized it and left it a miserable ruin with nothing but a staircase—leading to nowhere—left standing. Among others to swell the list of sufferers in sheds and ricks, are Mr. Blandford, Mr. F. Cooper, Mr. W. Slade, Mr. W. Early, Mr. Ward, Mr. Drake, Mr. C. Flux, Mr. Paige, Mr. H. Dunford, the landlord of the Travellers' Try Inn. Several out-of-the-way places felt the storm, but those mentioned above bore the brunt of it.

The most surprising thing, after viewing the whole scene of the disaster, and considering that in Cowes the storm is considered to have lasted for about two minutes, during which frightful missiles were flying about in all directions, is that no one was—indeed, that dozens were—not killed on the spot. As it is, we know of no case of fatal injury, though of numerous wonderful escapes. In the High-street a little girl was blown some fifteen feet in the air, but she alighted uninjured. Of course, the greatest interest was felt by all the inhabitants and visitors in ascertaining the effects of the storm, and the chief scenes of disaster have since been visited by the leading clergy and gentry, who were most sympathetic with the sufferers, Mr. Mursell, of the Globe Hotel, as chief amongst them, being greatly commiserated. Mr. Horan, the deputy chief constable, with his local staff of police, was very early on the spot, and has been indefatigable in providing for the general safety, and all unsafe buildings are being shored up. It may truly be said that the loss of property—estimated at upwards of £15,000—is deplorable, and it is to be hoped that the suggestion that a public subscription should be got up for the sufferers will be generously acted upon.—*Portsmouth Times*, September 30th.

“The destructive tornado experienced at West Cowes on Thursday morning, seems to have crossed over the Solent from that place in a north-easterly direction, and, striking the main coast of Hampshire near the entrance of the Southampton Water, passed up the county between Titchfield and Portsmouth, effecting much damage in the course of its progress. The shore at the point named (which is about five miles from Cowes) and some of the roads leading towards Fareham, were thickly strewn with portions of barley sheaves supposed to have been carried by the wind across from the Isle of Wight, where ricks totally disappeared. The storm is described by persons who saw its advance, as having the appearance of an immense black cloud sweeping along the ground. Accounts which have been received from different parts of the district state that turnips and other growing

crops were literally dragged out of the ground, and at Southwick-park (the residence of Mr. Thomas Thistlethwayte), about four miles north-east of Fareham, several fine oak trees were uprooted. In the neighbourhood of Meonstoke, a small village nine miles north-east of Fareham, five miles east-north-east of Bishop's Waltham, and about 16 miles north-east of Cowes, as the crow flies, a great deal of damage was done to several farms and homesteads. One man was killed and a boy injured. A barn, on the floor of which a man was at work, was lifted bodily and converted into a heap of ruins, the man miraculously escaping. All the windows in the farmhouse were blown out. Some sheaves of wheat in the valley of Meonstoke were carried up on to a hill called Old Winchester-hill, a distance of 400 to 500 yards. A clean sweep was made through a thick copse, the path of the hurricane being about 100 ft. in width, along which the trees and underwood were all uprooted, as though men had grubbed up everything, while in some cases the corners of ricks and also of cottages were cut off as if with a knife. Iron pig-troughs were carried a distance of 300 or 400 yards, and gates were lifted off their hinges and thrown into the adjacent fields. A rough estimate of the damage at Cowes by the whirlwind gives the amount at £10,000 or £12,000. The ruins in the town have been visited by large numbers of people.—*The Times*, October 2nd.

Perhaps it may be well to state in a single paragraph what at present *appears* to have occurred. The wind at Hurst Castle on the morning of the 28th ult., was W.S.W., and the general direction of the wind over South Hampshire appears to have been between S. and W. An ordinary rapidly revolving whirlwind, looking like a waterspout, or a huge funnel, point downwards, came on the S.W. shore of the Isle of Wight, about half-way between Black Gang Chine and the Needles. The same, or another, passed north-eastwards over Cowes, causing by its updraught, great wreckage in the town, carrying off corn, light articles, and even one or more bricks, dropping some in the Solent, and carrying some north-eastwards on to the mainland south of Titchfield. Then there comes a puzzle—considerable damage is reported at Southwick, and also at Meonstoke. Now, a straight line from Motteston (where the whirlwind is reported to have come on the shore of the Isle of Wight) to Meonstoke passes exactly over Cowes, and we believe over the Hampshire shore, where the Isle of Wight barley was found. And thus we should have the usual fact of the whirlwind moving in the same direction as the general wind, viz., S. 30° W. to N. 30° E., the most noticeable feature being the extraordinary length of the path, 28 miles. But Southwick Park lies five miles E. of this track, and, although the damage reported to have occurred there is limited to "several fine oak trees uprooted" this is more than we should have expected to occur so far from the central line.

Probably, however, it is fortunate that all the facts do not fall in with our theory, because even a single exception throws doubt upon the whole, and, therefore, raises the probability that whoever devotes himself to this storm will gain much useful information.

THE BRITISH ASSOCIATION AT GLASGOW.

METEOROLOGICALLY the recent meeting cannot be regarded as satisfactory. There has hardly ever been so few papers upon Meteorology; although there were several first-rate Meteorologists present, they scarcely spoke, and there was not a single paper on Scottish Meteorology or by a Scotchman, for Sir W. Thomson is a cosmopolitan.

We believe that the following list of Meteorologists present is nearly complete :—

* Barrett, Prof. ....Dublin.	M'Cullough, Dr.....Abergavenny.
* Boyd, J. K.....Belfast.	Mackeson, H. B. ....Hythe.
Brenan, Rev. S. A. ...Pomeroy.	* Mello, Rev. J. M. Chesterfield.
* Brooke, C., F.R.S.....London.	Miller, Dr. T. ....Perth.
* Buchan, A., F.R.S.E....Edinburgh.	* Muirhead, H., M.D. ...Cambuslang.
Chapman, Dr.....Hereford.	Mylne, R. W., C.E. ...London.
* Crompton, Rev. J. ....Norwich.	Pengelly, W., F.R.S...Torquay.
Dowson, E. T.....Beccles.	* Pim, Capt. Bedford, M.P. London.
Dunlop, W. H. ....Kilmarnock.	Rawson, Sir R. W., G.C.B. ,,
Everett, Prof. J. D. ...Belfast.	* Rodwell, G. F. .. ....Marlborough.
* Field, Rogers, C.E. ...London.	* Sewell, Rev. Prof. ....Ilkley.
* Gilbert, J. H., F.R.S...Harpenden.	Smith, B. W. ... ....Hampstead.
* Gilchrist, J., M.D.....Dumfries.	Smyth, J. Junr., C.E. ...Banbridge.
Glaisher, J., F.R.S. ...Blackheath.	Sopwith, T., F.R.S. ...London.
Grant, Prof. R., F.R.S. Glasgow.	* Stevenson, W.....Dunse.
* Harrison, J. P. ....Norwood.	* Symons, G. J. ....London.
Hart, R. ....Glasgow.	Verney, Capt., R.N. ...Bangor.
Hennessey, Prof. H. ...Dublin.	* Whipple, G. M. ....Kew.
Herschell, Prof. A. S....Newcastle.	Willis, G. O.....Monmouth.
Home, D. Milne .....Wedderburn.	Woodd, C. H. L. ....Hampstead.
* Jackson, M. . ....Ramsgate.	

There were only eleven reports and papers read upon Meteorology, viz. :—

1. Report of the Underground Temperature Committee.
2. " " " Luminous Meteor Committee.
3. " " " Rainfall Committee.
4. Sir W. Thomson. Physical Explanation of the Mackerel sky.
5. G. J. Symons. New Form of Thermometer for observing Earth temperature.
6. " " Unmistakeable True North Compass.
7. Prof. Clerk Maxwell. On the Protection of Buildings from Lightning.
8. Prof. Hennessey. On the Decrease of Temperature with height on the earth's surface.
9. " " " On the Distribution of Temperature over the British Isles.
10. J. Y. Buchanan. On a new Deep Sea Thermometer. (Read in the Geographical Section.)
11. C. Meldrum. On the Cyclones of the Indian Ocean.

THE METEOROLOGICAL BREAKFAST.

This was, probably, the best meteorological feature of the Glasgow meeting. As mentioned in our August number, the breakfast was this year given by Dr. Muirhead, of Cambuslang, and as his instructions were that the term Meteorologists should include persons interested in the subject, there was, at the usual hour, a gathering of 40 persons. We have not a perfect list of those present, but we have prefixed an asterisk to the names (in the above list) of such persons as we re-

member to have seen. The whole passed off very well, and we trust that as in previous years the great aim of the movement, viz., increased communication between fellow-workers, was kept in sight.

UNDERGROUND TEMPERATURE.

Professor Everett gave in the report of the Underground Temperature Committee. He began by explaining some of the thermometers which had been used for particular purposes, and afterwards said that the subject which had been under the consideration of the committee was the convection of water in bores and of the means to prevent it. There was an exceedingly deep bore at Sperenberg, about 20 miles from Berlin. It was 4,172 English feet, deep, and the bore was almost entirely through rock salt, and full of water, and the temperature at the surface was $48^{\circ} \cdot 2$ F.; at 720 feet the temperature was $70^{\circ} \cdot 7$, and at 3,490 feet, the deepest point at which reliable observations were obtained, the temperature was $115^{\circ} \cdot 7$, and that gave one degree F. to $51\frac{1}{4}$ feet. These observations showed that there was a decided decrease of the rate of increase as the bore was deepened. The committee had next directed their attention to plugging, and the most careful observations had been made to ascertain the effect of convection, and whether plugging was necessary. The first experiment was made to ascertain whether the water at the bottom of the bore had the normal temperature of the surrounding rock, because if the water at the bottom did not possess that qualification the water in other parts would not. The way in which it was tested was, that when the bore had gone to a certain depth, an advance bore was made of smaller diameter; and into that advance bore a thermometer was let down, and the bore then plugged at the place where it communicated with the big bore. The thermometer on being taken out gave a temperature of something more than $113^{\circ} \cdot 0$, and the same thermometer let down without the bore being plugged gave a reading of $106^{\circ} \cdot 2$. Another thermometer of a different construction gave readings similar to those of the other. The committee had under consideration the obtaining of a plug which would effectually separate the water of the bore below from that above, and at the same time be easy to let down and draw up. Great difficulty had been experienced in reference to that point, and the aim of the committee would now be to secure such an appliance in order to get correct observations.

Additional experiments had been made at a place called Swinderby, near Scarle, Lincoln, 2,000 feet deep, which he understood was the deepest bore in the East of England. At that depth the temperature was found to be 79° F., and deducting from that the temperature of the surface (50°) gave a difference of 29° . Another observation at 1959 feet gave a temperature of 78° . Favourable observations had also been taken at Angers, in the North of France.

In answer to questions,

Professor Everett said that he had heard of the observations taken at a bore in St. Louis, in the United States, at a depth of 3,800 feet; but they had been taken under such circumstances as tended to make the results obtained untrustworthy. He also understood that several experiments were to be made in the Mont Cenis tunnel during the next year.

REPORT ON LUMINOUS METEORS.

Professor Herschel (for Mr. J. Glaisher, F.R.S.) submitted the report of the Luminous Meteor Committee. He said that during the past year they had had several remarkable instances of meteoric showers, two of them the most remarkable which had ever come under their notice. On the 7th and 14th September, two very brilliant detonating meteors were seen. The one terminated over Cheltenham, and the other over the borders of Yorkshire, the latter coming to within fourteen miles of the surface of the earth. There could be little doubt that these meteors were composed of solid material, and were the only instances that they had of meteors precipitating solid substances to the earth. The present year's recurrence of the August shower was less plentiful than had been visible for several years past, and had amounted to a real minimum of intensity of its

unusual apparitions. Some researches and investigations relating to meteoric astronomy were described and concluded with an account of recent remarkable occurrences. One of the most interesting was that of a mass of iron, weighing 7½ lbs., that fell at Rowton, near Wolverhampton, which was only the seventh instance where such a mass had actually been seen to fall.

Mr. Glaisher thanked the secretary of the committee (Professor Herschel) for having read the report for him, and moved that it should be received and adopted. He expressed his sense of the great industry of Professor Herschel, who, notwithstanding his great labours, had devoted much time to the work of the committee. The Association, by appointing a committee, had taken a most important step, as their knowledge in regard to this subject was just beginning, and their efforts would increase that knowledge.

REPORT OF THE RAINFALL COMMITTEE FOR THE YEAR 1875-6.

IN accordance with the resolution of the Association, the Rainfall Committee originally appointed in the year 1865, now present their final report.

They gave in the report presented at Bristol in 1875, a condensed account of the contents of their previous reports.

This year they present the various tables and explanatory remarks upon them necessary to complete the work up to the present time, excepting that which is referred to in the seventh following paragraph.

Examination of Rain Gauges in situ.—Annexed to this report are the results of the examination of 26 rain gauges visited since August, 1875. This brings the entire number which have been visited and examined up to 655. The position and wide distribution of these inspected stations are illustrated by the annexed map. The Committee regard this as a very important subject, and the best guarantee of the accuracy of the records furnished by the observers. They have more than once expressed their conviction that the proper course would have been to appoint a travelling inspector, so that the whole of the gauges might be properly examined; but they have never had adequate funds for the purpose. In fact, the total amount they have been able to devote to it in the 15 years during which the inspections have been going on, has only been £210, or an average of exactly £14 a year. The explanation of the smallness of the amount in comparison with the work effected (about 6s. 5d. per station visited) arises from the fact that it has been almost entirely done by our Secretary, who, as a member of the Association, received nothing for his services but merely repayment of actual expenses, and even these have been materially reduced by the hospitality of the observers.

Rainfall of the years 1874-5.—The usual biennial tables of monthly rainfall at selected stations are appended. Ever since their appointment the Committee have continued these biennial tables, and as Mr. Symons had submitted similar ones for some years previous to their appointment, the entire series embraces sixteen consecutive years. Subject only to changes rendered necessary by the removal or death of observers, the same stations have been quoted in each biennial table, and thus these tables contain about 200 perfect records, each extending over sixteen consecutive years. Only those persons who are aware of the great importance of continuity in physical researches will fully realize the value of this series, both for physical and hydrological purposes.

The Rainfall of 1874 was slightly below the average, owing to a rather dry spring and exceedingly dry summer. The most remarkable feature of the year was the heavy fall of rain on October 6th, when the average fall over England and Wales was slightly above 1 inch in the 24 hours, and the fall at many stations in North Wales and the Lake District was upwards of 5 inches. So heavy a fall over so large an area is a very rare occurrence.

The Rainfall of 1875 was greatly above the average in England (especially in the Midland Counties), and irregular in Scotland and Ireland. A very heavy rainfall occurred in Wales and the Southern parts of England on July 14th, the fall in 24 hours exceeded 1 inch at 252 stations, 2 inches at 109, 3 inches at 39, 4 inches at 7, and 5 inches at 3 stations.

New Irish Stations.—We reported last year the success of our efforts to in-

prove the geographical distribution of Rainfall Stations in Ireland, showed that the gauges started at the cost of the Association had been supplemented by many others established at the cost of private individuals, and gave a map showing the present complete distribution of stations. Almost all the observers have proved good ones, and, as the table shows, the returns have been forwarded with regularity. The period is too short to yield precise results, but a good system has been inaugurated and is in full operation.

At the commencement of this report it was stated that there was one very important exception to the otherwise satisfactory completion of the work up to the present time. This exception is the classified list of stations, and the results of the "position-returns" which we intended to have incorporated therewith. In 1865 we published a complete list of every station in the British Isles at which rainfall observations were known to have been made, giving the observers' names, the height of the stations above mean sea level, the epoch of the observations, and various other details. Owing to the large development of rainfall work during the subsequent 10 years, the list has become very imperfect, and the Committee have been actively engaged in the preparation of a revised list. In addition to the details previously given, the list was also to have contained other most valuable information. The "position-returns" obtained from the various stations and which have been mentioned in previous reports, were to have been summarized, and the results indicated by symbols affixed to the stations in the classified list, and references to publications in which the records could be found were also to have been added. The classified list of stations would thus have formed a complete *catalogue raisonné* of all the existing rainfall data, and have given most useful information at present non-existent. To the great regret of the Committee, the Association declined to publish the portion of this list presented last year, and the Committee have therefore felt compelled to relinquish its completion. They the more deeply regret this, as they consider that the publication of this list would have been a fitting termination of their work, and would have redounded to the credit of the Association.

Notwithstanding the above most important omission, the Committee feel they have done good service to rainfall work. When they commenced their labours, the weakest part of rainfall observations was the defective geographical distribution of the stations. This defect has now been very materially lessened. By the grants of the Association nearly 250 gauges have been erected in districts hitherto without observations. The work done in the inspection of stations has already been mentioned. A definite unit has been adopted for the term "rainy day," namely, any day on which one 100th of an inch of rain falls. A complete code of rules has been drawn up, so as to secure uniformity of practice among observers. The secular variation of the rainfall of the British Isles has been investigated. A determination of the average proportion of the total yearly rainfall which occurs in each month has been effected. Elaborate observations have been made and discussed on the relative quantity of rain indicated by gauges of various sizes and shapes, and erected at different heights above the ground.

To sum up their labours in a sentence, your Committee have aimed—they hope not without success—primarily at obtaining unimpeachable records; and, secondarily, at so discussing and arranging these records as to render them as useful as possible to physical enquirers and hydraulic engineers.

Mr. SYMONS (Secretary) having read the report,

Mr. F. J. BRAMWELL, F.R.S., said that he was aware that it was contrary to the rules of the Association to discuss reports, but he felt much inclined to ask Mr. Symons a question with reference to the continuance of rainfall observations after the cessation of the labours of the Association's Committee. "What was to be the future of rainfall observations?"

Mr. SYMONS having intimated that a reply to that question would occupy some little time,

The PRESIDENT put it to the meeting whether the members desired to hear Mr. Symons' statement or not, and it was unanimously decided affirmatively.

Mr. SYMONS said that up to 1858 there had been no attempt whatever to collect in any single publication all systematic rain records. Accordingly, in 1860, he himself had commenced by issuing a leaflet, containing such returns as he could collect, and this had gone on till matters had reached their present stage. The action of the Association had been to supplement his work, principally by defraying the expenses of branches of it which could not otherwise have been met. In early years a large proportion of the grants was expended in providing rain gauges gratuitously to persons resident in districts where observations were necessary, and had not been made, thus observers had been scattered throughout the country. They belonged to all classes, from shepherds who took the gauges on the mountains, and were paid by himself, to noblemen and gentlemen who bore some portion of the expense of the inquiry. The consequence was that at the present moment we had in this country a system of observation which was the admiration of other countries, and was being imitated in France, America, &c.; that system now embraced some 2,000 stations, so disseminated that it was scarcely possible to drop on any district in the British Isles which was more than four or five miles distant from a station. Therefore, also, when hydraulic and water-works questions turned up, data were almost always available, which did not exist ten years ago, for ascertaining the quantity of water which could be collected from any given gathering ground.

With respect to the future maintenance of this system it simply rested with himself, and if anything happened to himself he did not quite see how the work could be maintained, but he hoped that a sufficient amount of interest would be awakened to make the sale of publications yield a sufficient revenue to maintain it. He was thankful for what the Association had done in the past, and regretted any breach in the connection between it and the Committee.

Captain GALTON, C.B., F.R.S., referred to the remark in the report respecting the desirability of appointing a permanent inspector of rain gauge stations, the whole or nearly the whole of whose time should be devoted to travelling inspection, and asked if Mr. Symons could state what such an officer would cost.

Mr. SYMONS said that the cost would be so far in excess of any funds hitherto at the disposal of the Committee or himself, that he had made no estimate; but as such an officer must be a person of scientific attainments, and would be brought into contact with all classes of observers, the salary could hardly be less than £100 or £150 per annum. To that must be added hotel and travelling expenses, for which he believed commercial travellers were allowed £1 per diem, at that rate the total cost would be nearly £500 per annum, which he need not say was far beyond what he could reasonably spare upon public work.

Dr. C. W. SIEMENS, F.R.S., explained that the work of the Committee had such an important bearing on the professional work of engineers, that it was felt that observations should be supported, if not by Government, by the leading engineering bodies. That was simply the reason why the grant to the Committee was not intended to be renewed by the Association.

Sir J. HAWKSHAW, F.R.S., stated that no one failed to appreciate the importance of the work undertaken by the Committee, but it was thought that that work should now be undertaken by engineers, who were so largely interested in it.

Mr. EDWIN CHADWICK, C.B., urged the importance of the work, as contributing to sanitary science, and that it should be comprised within the functions of the local sanitary authorities, beginning with the greater provincial centres, such as Glasgow and the chief provincial cities. The Registrar-General included the observations of the rainfall in his periodical reports of the meteorology, and the local sanitary authorities should follow the practice closely for their respective districts. Agriculture would be interested in these observations, and in connection with sanitary administration they would be best utilized and popularized.

Mr. BRAMWELL thought it would be well to bring the influence of the section to bear on this question, and he, therefore, moved :—

“That in the opinion of Section G, the labours of the Rainfall Committee have proved most useful, that it is in the highest degree desirable that the Committee should be continued, and that further money grants should be made as occasion may require.”

Sir JOHN HAWKSHAW supported the motion, it was put by the President and unanimously agreed to.

The PRESIDENT considered that it would be a great misfortune were the observations referred to discontinued, but it was generally felt that the funds of the Association are best employed in initiating any good and valuable work of this kind, and that when once set agoing it should be left to those chiefly interested in maintaining it. It was also objectionable to grant anything like a permanent annuity out of the funds of the Association, but he should take care that the matter was considered in Committee.

On the following day the President reported that the matter had been considered in the Committee of the Section, and that the following resolution had been passed :—

“The Committee have taken into consideration the resolution of the Section as to the re-appointment of the Committee on the Rainfall of the British Isles; but after conferring with Mr. Symons, they have concluded that the time has now arrived when this work should be taken up in a larger public spirit, and consequently that the grant hitherto made should now cease. The Committee do so with the confident expectation that those who have hitherto so greatly benefited by

the laborious and successful work carried on by Mr. Symons for the Association, will come forward and make this work of the Rainfall their own. The Committee of Section G records its most hearty and warmest thanks to Mr. Symons for his valuable services, which have proved so important to many branches of science, and have redounded to the credit of the British Association."

PHYSICAL EXPLANATION OF THE MACKEREL SKY.

Sir Wm. Thomson explained the relation of the clouds and their movements, and that it was not essential to the formation of a mackerel sky that there should be two different temperatures. All that was essential was that portions of air should be moving up and down; and further, that the up and down motion should seem as though it resulted from the slipping of one stratum of air upon another and the production thereby of waves; and the second essential was that one or other of the two portions of air should be very near the point of saturation—that it would be clear when down at its lowest point and cloudy when up at its highest.

Professor Andrews said he had had great pleasure in listening to Sir Wm. Thomson, for that was a subject in which he had himself been interested for the last ten years. He was happy to hear it so well explained, as the subject was one of enormous difficulty. He had been given to understand that a mackerel sky was an indication of fine weather, and that the primary cloud formation was the reverse. He further expressed a desire that some of the photographers should devote their attention to these clouds and get some photographs of them.

Mr. Glaisher said he had heard it said that there were no flat-bottomed clouds; but on one occasion when up in a balloon to the height of 2,400 ft., he passed through a cloud which was decidedly flat-bottomed. The dry east wind was acting on the lower part like a knife, and so making it flat. On other occasions, at whatever height he was, when he passed from a low temperature to a higher, he was always sure to find the clouds flat-bottomed.

Captain Abney, R.E., Rochester, remarked that he had taken numerous photographs of the clouds, and especially of the mackerel sky, and he would be happy to send a series of them to the President of the Association for his study.

THERMOMETER FOR OBSERVING EARTH TEMPERATURE.

Mr. G. J. Symons submitted a new form of thermometer for getting the temperature at small depths below the surface with ease and facility, and which was specially applicable for determining the temperature at which plants grow. The old form of thermometer was extremely inconvenient, as the observer had to put his head down upon the ground in order to read the thermometer, whereas by the new plan all inconvenience of that sort was avoided, and at the same time it would enable a thermometer of greater delicacy to be employed. It was also available for determining the temperature of the inside of hay ricks, in the holds of ships, and in other places where spontaneous combustion was likely to occur. An iron tube of the required depth is sunk into the ground, and the thermometer attached to a chain is dropped to the bottom, a lid being placed on the top of the tube to exclude the rain. This thermometer, which can be sunk to a depth of 10 feet or more, has given good results.

The thanks of the section were awarded to Mr. Symons for his new form of thermometer.

UNMISTAKEABLE TRUE NORTH COMPASS.

Mr. G. J. Symons read a paper on his patent Unmistakable Compass. He said it was not generally known, except to nautical and to scientific men, that the compasses usually sold did not point to the true North or South Pole of the earth, or agree with the positions represented upon maps. The fact was, the magnetic Pole, to which all compass needles pointed, was not identical with the geographical pole, which was the north point of all maps. The difference

between the two was considerable, and was no doubt often the cause of tourists losing their way. The difference between true and magnetic north was not absolutely the same in all parts of the United Kingdom, and *à fortiori* in all parts of the globe, nor was it absolutely the same from year to year. One of the essential superiorities of these instruments was their pointing to the true north, the other was their "unmistakableness." These compasses were corrected for use in the United Kingdom, but could be adapted to any specified locality in any part of the world. They, as well as the thermometer above-mentioned, were made by Mr. Casella, of Holborn.

PROTECTION OF BUILDINGS FROM LIGHTNING.

Professor Forbes read a paper by Professor Clerk Maxwell on the Protection of Buildings from Lightning. The paper stated that those who erected lightning conductors had paid great attention to the upper and lower extremities of the conductor—having a sharp point above the building, and the lower extremity carried into the earth as far as possible. The effect was to tap, as it were, the gathering charge by facilitating the discharge between the atmospheric accumulation and the earth. That would cause a greater number of discharges than would have otherwise occurred; but each of them would be smaller than those which would have occurred without a conductor. That arrangement was, therefore, more for the benefit of the surrounding country, and for the relief of the clouds labouring under an accumulation of electricity, than for the protection of the building on which the conductor was erected. What was really wanted was to prevent the possibility of an electric discharge taking place within a certain region. An electrical discharge could not occur between two bodies unless the difference of their potentials was sufficiently great compared with the distance between them. If, therefore, they could keep the potentials of all bodies within a certain region equal or nearly equal, no discharge would take place between them. That might be secured by connecting all these bodies by means of good conductors, such as copper wire ropes. It would, he considered, be sufficient to surround a powder mill with a conducting material, to sheath its roofs, walls, and ground floor with a thick sheet of copper, and then no electrical effect could occur within it on account of any thunderstorm outside. There would be no need of any earth connection. They might even place a layer of asphalt between the copper floor and the ground, so as to insulate the building. If the mill were struck it would remain charged for some time, and a person standing on the ground outside or touching the wall might receive a shock, but no electrical effect would be perceived inside, even by the most delicate electrometer. A sheathing of copper was by no means necessary in order to prevent any electrical effect taking place, supposing a building were struck by lightning; it was quite sufficient to enclose it with a network of good conducting substance. For instance, if a copper rod were carried round the foundations of a house, up each of the corners and gables, and along the ridges, that would be a sufficient protection for an ordinary building against any thunderstorm in this climate; but it might be well to prevent theft, to have it built in the wall, and then it would be necessary to have it connected with some metal, such as lead or zinc, on the roof. In the case of a powder-mill, it might be advisable to make the network closer by carrying one or two rods over the roof and down the walls to that at the foundation. If there were water or gas pipes entering the building from without, these must be connected with the system of conducting wires, but if there were no such metallic connections with distant points, it was not necessary to take any pains to allow the escape of electricity into the earth; still less was it advisable to erect a tall conductor with a sharp point in order to relieve thunder-clouds of their charge. It need scarcely be added, says the writer, that it is not advisable during a thunderstorm to stand on the roof of a house so protected, or to stand on the ground outside, or to lean against the walls.

On the motion of Mr. Symons, it was agreed to thank Professor Maxwell, and that the paper be printed entire in the transactions of the Association, in order that there might be time to study the subject which he had introduced.

SEPTEMBER, 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.			
		inches	inches.	in.								In shade	On grass
I.	Camden Town	2·86	+ ·60	·64	4	22	71·4	21	41·3	13	0	0	0
II.	Maidstone (Linton Park)	3·34	+ 1·12	·49	5	25	74·0	5*	43·0	13	0	0	0
III.	Selborne (The Wakes)	5·32	+ 2·88	·74	30	23	67·0	22	35·8	15	0	0	0
IV.	Hitchen	5·08	+ 3·22	1·12	5	20	66·0	4	39·0	12	0	0	0
V.	Banbury	5·80	+ 3·43	1·40	28	23	69·0	22	39·0	20	0	0	0
VI.	Bury St. Edmunds (Culford)	4·45	+ 2·84	·66	5	21	72·0	5	36·0	14	0	0	0
VII.	Norwich (Sprowston)	5·07	...	·68	13	25	...	...	...	...	...	...	...
VIII.	Bridport	5·65	+ 3·33	·80	23	20	80·0	21	43·0	15	0	0	0
IX.	Barnstaple	5·77	+ 2·01	·75	7	24	74·0	22	49·0	13	0	0	0
X.	Bodmin	6·29	+ 2·62	·94	29	26	68·0	22	46·0	12	0	0	0
XI.	Cirencester	5·66	+ 2·80	·76	30	22	...	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	4·52	+ 2·57	·60	28	23	67·0	5	...	...	0	0	0
XIII.	Tenbury (Orleton)	5·51	+ 2·83	1·09	30	24	71·7	21	39·7	19	0	0	0
XIV.	Leicester (Belmont Villas)	5·60	...	·80	18	20	73·5	21	41·8	15	0	0	0
XV.	Boston	5·24	+ 3·67	·71	30	25	72·0	22	43·0	15	0	0	0
XVI.	Grimsby (Killingholme)	3·26	...	·51	30	23	68·0	4, 5	44·0	12†	0	0	0
XVII.	Mansfield	4·49	...	·92	30	27	71·4	21	39·4	15	0	0	0
XVIII.	Manchester	3·17	— ·52	·58	24	21	75·5	22	39·5	3	0	0	0
XIX.	York	5·08	+ 2·75	·86	22	23	70·0	22	41·0	11	0	0	0
XX.	Skipton (Arncliffe)	5·60	+ ·64	1·01	4	26	72·0	21	34·0	18	0	0	0
XXI.	North Shields	2·74	+ 1·04	·52	26	23	64·0	5	41·0	12	0	0	0
XXII.	Borrowdale (Seathwaite)	8·23	— 4·98	1·37	5	15	...	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	7·82	+ 4·11	1·98	27	16	68·0	23	42·5	28	0	0	0
XXV.	Machynlleth	6·12	...	1·02	24	23	76·0	24	32·5	14	0	0	0
XXVI.	Llandudno	4·06	+ 1·72	·76	30	24	74·6	21	41·5	15	0	0	0
XXVII.	Dumfries (Crichton Asylum)	3·84	+ ·90	·65	3	17	71·8	23	35·3	12	0	0	0
XXVIII.	Hawick (Silverburn Hall)	2·55	...	·41	1	17	...	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill)	2·56	...	·59	4	16	67·0	22	35·6	14	0	0	0
XXX.	Castle Toward	2·87	— 1·75	·79	25	10	67·0	21	34·0	14	0	0	0
XXXI.	Mull (Quinish)	2·71	...	·52	6	10	...	...	...	...	...	...	...
XXXII.	Leven (Nookton) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	2·72	...	·71	24	10	...	...	...	...	...	...	...
XXXIV.	Braemar	2·55	— ·09	·52	24	20	68·0	22	30·2	3, 30	3	6	6
XXXV.	Aberdeen	3·30	...	·85	4	20	64·2	5	38·5	3	0	1	1
XXXVI.	Loch Broom	3·17	...	·28	25	24	...	...	...	...	...	...	...
XXXVII.	Portree	3·17	— 7·59	·83	5	21	...	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	3·64	+ ·95	·54	25	18	65·7	22	35·9	30	0	2	2
XXXIX.	Helmsdale	2·35	...	·43	6	23	...	...	...	...	...	...	...
XL.	Sandwick	3·18	— ·48	·80	5	22	57·8	16	39·3	4	0	0	0
XLI.	Caherciveen Darrynane Abbey	7·11	...	1·30	6	23	...	...	...	...	...	...	...
XLII.	Cork	5·24	...	·85	24	17	...	...	...	...	...	...	...
XLIII.	Waterford	5·76	+ 2·63	·95	15	24	68·0	1, 2	44·0	19	0	0	0
XLIV.	Killaloe	5·30	+ 1·14	·93	25	22	76·0	24	34·0	15	0	0	0
XLV.	Portarlington	3·82	+ ·54	·83	26	27	66·0	23	33·5	14	0	0	0
XLVI.	Monkstown, Dublin	3·39	+ 1·40	·53	22	17	...	...	...	...	...	...	...
XLVII.	Galway	5·61	...	1·18	9	17	66·0	1	31·0	20	2	2	2
XLVIII.	Ballyshannon	3·70	...	·88	4	18	...	...	...	...	...	...	...
XLIX.	Waringstown	3·29	...	·45	16	20	70·0	4	34·0	14	0	1	1
L.	Edenfel (Omagh)	4·06	...	·83	4	20	65·0	20	32·0	14	1	1	1

* And 21, 22. † 13.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER.

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 wet, but not cold month, R falling more or less on every day but the 3rd, 11th, 13th, and 26th. A little T on the 7th; winds mostly from S. and S.W., but never very high. On the whole the ample rainfall was needed, as well for domestic use as for vegetation.

SELBORNE.—A very wet month, greatly retarding vegetation and all garden work; 20th, a swarm of bees in my garden; temp. 62°. Dense fog on 21st, 22nd, and 23rd; 28th, violent wind and R before 9 a.m.

HITCHIN.—The wettest and most thundery September on our record, extending over 27 years.

BANBURY.—High winds on 4th, 5th, 23rd, 24th, 28th and 30th; TS on 17th.

CULFORD.—The weather throughout the month has been excessively wet, exceeding the average by nearly 3 in.; W. and S.W. winds prevailed on 24 days; T on 7th, 9th, 18th, and 28th. A meteor of extraordinary brilliancy startled all who were out of doors about 6.30 p.m. on Sunday the 24th.

SPROWSTON.—The wettest September almost ever known in Norfolk. A very bright meteor seen at 6.30 p.m. on 24th. Rainfall of the 9 months is 22.13 in., or about 5.50 in. above the average.

BODMIN.—Average temp. of the month 59°·5; rainfall 2.37 in. above the average of 27 years.

SHIFNAL.—A rainy, damp, unpleasant month. The nights were cold for the time of year, and the max. ther. never rose above 67°. Autumnal butterflies rare, only *one* red admiral, and but few white ones seen. Damsons a very poor crop, their substitute—blackberries—abundant. Few strong winds, not even at the equinox.

ORLETON.—A very rainy damp month, with only a few dry days, from the 19th to the 22nd, these fortunately allowed some of the late crops to be secured. Great rainfall after the 22nd to the end of the month. Storms of T and L on 17th and 23rd. Mean temp. of the month nearly 1° below the average, but the fluctuations were less than usual.

LEICESTER.—More rain (5.60 in.) has fallen than in the four previous months, only 1.11 in. fell during the first half of the month, and 4.49 in. in the latter half; the 19th, 20th, 21st, and 22nd were unusually fine and cloudless days. Severe TS between 4 and 5 p.m. on 18th, L very vivid. From early morning of 23rd to the end of the month 3.34 in. fell (none falling on 29th). Owing to the deficiency of R in the previous months there have been no floods.

BOSTON.—The heaviest rainfall (5.24 in.) ever known in September; the quantity has only been exceeded three times in the last 26 years, viz. in July, 1851, 5.73 in.; August, 1860, 5.35 in.; and Dec., 1868, 5.87 in.

GRIMSBY.—A wet, ungenial month, the exact reverse of the preceding September. A little corn still left in the fields; turnips, swedes, and mangolds a heavy crop; fears are felt for the potatoes still in the ground. T on 7th, 8th, and 17th. Brilliant meteor at 6.30 p.m. on 24th.

MANSFIELD.—This month is noteworthy for its almost uninterrupted sequence of wet days, or more properly days on which R fell, for none of them, except those at the end of the month, could properly be called wet days, the R falling frequently in the night or early morning. 19th, 20th, and 21st were the only ones without rain, and they were beautifully bright days.

NORTH SHIELDS.—Lunar halo on 3rd; TS on 17th; T on 14th.

SEATHWAITE.—T on 22nd and 24th. Only three days on which 1.00 in. or more was measured, and they were the three consecutive days, 3rd, 4th, and 5th; the total fall, 8.23 in., is near five inches below the average.

WALES.

HAVERFORDWEST.—A cold, ungenial, gloomy, and wet month; a few fine days from 15th to 23rd. Rainfall 1'00 in. or more on 3rd, 22nd, and 28th; on the latter date 1'98 in. fell between 2 and 5 a.m., causing great and sudden floods in many places. Temperature considerably below the average throughout the month. Great damage to the potato crop from the excessive rain, the fall (7'82 in.) being more than double the average. Severe T S on 24th at St. David's, forked L; two houses struck, one little girl killed, the rest of the family paralyzed for a time. Heavy storm of R and wind from 2 to 4.30 a.m. on 28th.

MACHYNLETH.—A very wet month; the temp. has been rather low all the month, only twice reaching 70°, but it has never fallen to 32°, the lowest being 32'5 on 14th. R daily till 11th, fine 12th, 13th, 14th, and 15th, followed by three wet days, and these by three fine ones, after which R fell daily to the close.

LLANDUDNO.—In every respect an unsettled month. Rainfall more than an inch above the average, and temperature 1'5 below it. 10th very fine, sheet L in the evening; 19th, 20th, and 21st, very fine; stormy nights on 25th and 26th.

SCOTLAND.

DUMFRIES.—This month has been humid, R having fallen on 17 days, the quantity (3'84 in.), being considerably above the average. The winds have been chiefly northerly, and hence the mean temp. (51'81) is 3'5 lower than last year. There have been no violent gales, and T has been but once recorded.

HAWICK.—The latter half of the month has been rather unfavourable for housing the grain, and there are complaints of some of the stacks heating, and having had to be taken down and spread out to dry. Potatoes are fine in quality, a good crop, and I have not yet seen one diseased tuber this season. Dahlias, heliotropes, and all the floral beauties of the garden are yet blooming gaily, not one of them having suffered from frost.

ANNANHILL.—Ozone scarce. Winds principally E. and W. usually light; eclipse of the moon on 3rd, not well seen; atmosphere foggy. T heard on 5th, 10th and 21st; L seen on 21st. Harvest generally secured, except in high lands in county; pastures still fair; potatoes shewing disease; lime-trees beginning to lose their leaves.

CASTLE TOWARD.—From 3rd to 9th showery, the weather then became fine, and we had a splendid week or two for the ingathering of the crops, which was taken advantage of, and towards the end of the month the fields were looking very bare. This month has made a great change in the appearance of the trees, many having lost their leaves, and those still on look very withered.

BRAEMAR.—A very wet unfavourable harvest month.

ABERDEEN.—Bar. pressure and temp. below the average, rainfall above it. Winds from N.W., N., N.E., and S. more frequent than usual; wind pressure below the average. A month of most unseasonable weather, chilly and damp rather than wet. Much grain still in the fields. 25 in. of R fell on the 8th in about an hour, the shower was local.

LOCHBROOM.—A very unpropitious month to the grain farmer, as he cut his crop the latter end of August, and the continued R and moisture of this month have prevented him from housing it yet, and such as was stacked is in a very unsatisfactory state, many stack-yards having to be spread out to dry.

PORTREE.—A dull damp month, very backward for harvesting, most of the corn is cut, but none of it has been carried. Strong frost on 1st and 2nd. Disease is making sad havoc amongst the potatoes. Solar halo all the afternoon of 3rd, and lunar halo at night. The driest September on record.

SANDWICK.—September has been rather cold in consequence of the northerly winds, and there were six days of continuous haze from 21st to 26th inclusive, but there was not much rainfall after the 18th, so the harvest work has been carried on, and in some districts the grain has all been cut.

IRELAND.

DARRYNANE.—A wet disagreeable month ; wind almost constantly N.W. till 19th, thence to end chiefly S.E. Fresh gale on morning of 24th. Hay harvest very backward, very few of the smaller farmers having theirs saved. TS on morning of 7th.

KILLALOE.—High westerly winds prevailed for the earlier part of the month. Temp. generally about the average, and vegetation good. 77 in. fell in about 20 minutes on the 17th, it was quite a tropical shower, and the most violent rainfall in the time ever noted here.

BALLYSHANNON.—The month has been a favourable one for the ingathering of the harvest. The potato crop is plentiful, and almost free from blight. Rainfall 35 in. greater than corresponding period in 1875.

WARINGSTOWN.—The month was on the whole favourable for harvest operations, and has left the country well cleared up. Crops fair, and saved in good condition.

EDENFEL, OMAGH.—The R. has been above the average, but having mostly fallen during the night, the ingathering of the harvest was not so much impeded as had been expected. Latter part of month very mild.

SUPPLEMENTARY TABLE OF RAINFALL IN SEPT., 1876.

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

Station.	Total Rain. in.	Station.	Total Rain. in.
Acol	3·23	Llanfrechfa	8·50
Hailsham	4·11	Castle Malgwyn	5·13
Andover	4·87	Heyope .....	...
Strathfield Turgiss	4·23	Rhug, Corwen	4·82
Addington Manor	4·84	Port Madoc	4·23
Oxford	5·60	Melrose	3·53
Cambridge	4·36	Cessnock, Glasgow	2·64
Sheering	3·51	Gruinart	3·22
Ipswich	3·57	Keith	7·92
Diss	4·76	Stratheonan	3·54
Swaffham	4·28	Springfield, Tain	3·32
Compton Bassett	5·81	Skibbereen	7·26
Dartmoor	12·77	Glenville, Fermoy	6·14
Teignmouth	6·38	Tralee	3·98
Torrington (Langtree) ..	7·02	Newcastle W., Limerick ..	3·99
Trevarrick, St. Austell..	6·23	Kilrush	3·40
Taunton	5·89	Kilkenny	3·98
Bristol	5·41	Kilsallaghan	4·23
Sansaw	5·20	Twyford, Athlone	6·07
Cheadle	5·69	Ballinasloe .....	...
Ashby-de-la-Zouch .....	...	Kylemore	6·15
Coston, Melton Mowbray	4·85	Bangor .....	...
Bucknall	3·61	Carrick on Shannon	6·45
Walton, Liverpool	4·07	Rockcorry	4·15
Broughton-in-Furness ..	5·67	Warrenpoint	4·43
Stanley, Wakefield	2·96	Bushmills	3·66
Gainford	3·78	Buncrana	3·84
Shap	4·73		

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXX.]

NOVEMBER, 1876.

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En Memoriam.

Prof. C. STE. CLAIRE-DEVILLE,
DIED
October 10th, 1876.

Dr. CARL JELINEK,
DIED
October 19th, 1876.

France has lost in M. C. Ste. Claire-Deville one of its foremost meteorologists, and one who, as Inspector-General of Meteorological Stations, was doing much to ensure that, without which Meteorology can make no progress—need we say that in thus writing we refer to uniformity of observation.

Germany has lost the Director of its finest Meteorological Observatory, and of its Meteorological system.

But the loss is not limited to these countries. Dr. Jelinek was the chief Editor of the *Zeitschrift der Österreichischen Gesellschaft für Meteorologie*, a journal which has no equal, and of which the circulation is only limited by the absence of a universal language. Jointly with Buys-Ballot, Scott and Wild, he may be regarded as the founder of the International Meteorological Congresses, while the success of the Vienna meeting was largely due to his personal exertions.

We need not go into details ; both men, by their writings and their labours, had deserved and obtained the esteem of their fellow-men, *e.g.*, they were both among the very select list (only 18) of Honorary Members of the Meteorological Society, and each will be regretted far beyond the limits of his own country.

SCIENCE AT SOUTH KENSINGTON.

(Continued from page 94).

1054. **Thermometer Stick**, for measuring temperatures at some depth.

Ludwig Meyer, Berlin.

Merely a hook-handled walking stick, pierced throughout. The bulb of the thermometer is in a clamp at the bottom near the ferrule, and the scale (the tube being bent) lies in the handle, which opens to enable it to be read.

Under Section 13, "Chemistry," among Class V. "Apparatus illustrating Agricultural Chemistry," we find—

2760. Soil Thermometer of peculiar construction.

Professor Dr. Leonard Roesler, Klosterneuburg.

This may best be described as a large gimlet, strongly made in iron, with a gimlet point, and a powerful cross-handle for driving it down. The pattern sent is about 4 ft. long, the scale of the thermometer is above the cross-handle, and alongside of it is a second thermometer, perhaps intended to give the temperature of the air on the surface of the ground.

Finally, under Section 14, "Meteorology," we have three other patterns—

2789f. Tube, Lath and Thermometer, by Hicks, A164, for taking earth temperatures.

Meteorological Office.

A rather thin brass case, a lath to which one or more thermometers could be attached and which drops into the brass case, and one of the thermometers.

2825. Von Lamont's Terrestrial Thermometer, for determining the temperature of soil from one to four feet deep.

Professor Ebermayer, Aschaffenburg.

2826f. Symons's Earth Thermometer.

L. Casella.

These have been so recently described and engraved in this Magazine (Vol. X. pp. 183-4) that we need only refer to that article for all details.

SOME OTHER BAROMETERS.

The collection is occasionally augmented, and now being dispersed, we take the present opportunity of mentioning two recently added barometers, at the same time that we extract from the paper mentioned in a previous number (and of which Dr. Wild has kindly sent us a copy), a few particulars respecting his modification of the syphon barometer.

The additions are:—

2789B. Portable Barometer, graduated on the glass tube, with a sliding vernier, invented and used by Sir J. Richardson, M.D.

Meteorological Office.

A pocket instrument very much resembling a sympiesometer. It was registered November 25th, 1839, the instrument having been made by Ronketti, of Museum-street, London.

A Self-registering Barometer.

Dr. G. F. Muller.

An extremely elaborate electrical recording barograph, which, however, appears to us far inferior to Redier's.

Wild's Syphon Barometer is a hardy rather than an elegant instrument. It is stated by Dr. Wild to be an improved form of the barometer used by Kupffer, and from the comparisons in the pamphlet quoted above, it evidently gives good results, while Dr. Wild's report upon its bearing transport is very satisfactory. Its construction is rather complex, and the inventor says that it is both heavier and dearer than a Fortin barometer. The general principle can, however, be easily understood. Fig. 24 gives a front view of the instrument; it consists of two tubes, one closed at the top to hold the barometric column, the other short one corresponds to the short leg of the usual form of syphon—a screw and tap at *A* close the short leg, and then the instrument can be rendered portable by the screw *B*. The reading is taken by making the collar *C* form a tangent to the top of the meniscus of the mercury in the short leg, then noting the reading of the other collar on the graduated tube, then a reading of the top of the long column is taken in the usual way, and subtracting the former from the latter, the height of the column is obtained.

ANEMOMETERS.

Following the order (such as it is) of the Catalogue, we proceed to notice the Anemometers.

We commence with one which we either do not understand, or, if we do, of which we fail to see the great value. The catalogue entry is as follows:—

2830. Static Anemometer, for measuring the force of the horizontal component of the wind, especially of gusts.

Scottish Meteorological Society, General Post Office Buildings, Edinburgh.

Two sets of Robinson's cup anemometers are placed one above the other on one vertical spindle, so that the couple tending to turn the spindle depends on the force of the horizontal component of the wind, not on its direction. To the spindle is attached a spring, so that the magnitude of the couple (and therefore the force of the horizontal component) is measured by the angle through which the spindle is turned. This is recorded by a pencil which is raised and lowered by a screw cut on the spindle. The clockwork and paper for recording have not been sent. Designed by Professor Crum Brown, M.D., F.R.S.E., Member of Council.

It seems to us, that as the motive power acts upon ordinary Robinson cups, this instrument registers more than the "horizontal component," for the vertical component acting on the inside of a hemisphere would surely exert some pressure. The record of an ordinary Robinson with four hemispheres has always appeared to us independent of direction, and we do not see what is gained by having eight, *i.e.*, one at each 45°. It appears to us that the instrument is virtually a pressure anemometer, with cups instead of a pressure plate, and therefore, as far as relates

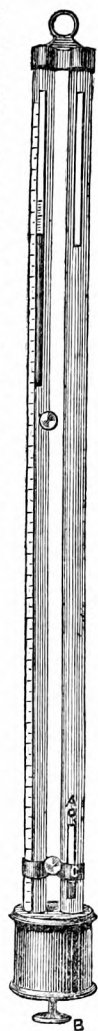


Fig. 24.

to azimuth, always in position for receiving the full force of the wind, which is not the case with pressure plates, whether governed by fans or vanes. As the resistance is that of a spring it is of course open to objection, on the ground of change of elasticity.

The **Robinson Cup** arrangement is represented in almost endless variety of detail and size ; as regards the latter quality the extremes are, one by Pastorelli (No. 2845), which would go comfortably in a coat pocket, and the full-size Meteorological Office pattern (2841A) by Casella, nearly 10 ft. high and 6 ft. across. We are inclined to regard this as the best velocity anemometer in the Exhibition, and Mr. Cator's (2879A)* as the best pressure instrument.

There must be nearly a dozen ordinary Robinson Cup Anemometers, some hardly distinguishable except by the names painted upon them. Several are arranged for registering (not recording†) electrically at a distance which we need not say—a very desirable feature, as positions where daily observations are impracticable become thereby available.

Howlett's Anemometer (2835b) is exhibited by Elliott Brothers ; but it has never commended itself to our approval, and we do not know of one that is at work. Its essential principle is the displacement from the perpendicular of a vertical rod suspended intermediately by a ball and socket joint having a light sphere on its upper and exposed end upon which the wind blows, while its lower weighted end carries a pencil. Evidently from whatever azimuth a puff of wind comes the ball will be driven and the pencil will travel towards that point of the compass, and the length of its trace will *cæteris paribus* be proportional to the force of the wind. This instrument evidently gives no indication of time. A *fac-simile* of the indications of one of these instruments is given in *Met. Mag.* Vol. III., p. 9.

Wild's Pendulum Anemometer (2784) is exhibited by the Meteorological Committee. It has the undoubted recommendation of being very inexpensive ; not having tried it, our opinion can be of little value, but we think that it must be very difficult to read. Its essential features are a long vane to secure steadiness of direction ; a slab of metal of known area and weight, supported at its two top corners at a right angle to the direction of the vane ; the bottom of the slab is free, and the stronger the wind the more is the slab blown from its naturally vertical position. A roughly notched scale is so fixed that the angle of deflection can be approximately read off.

A specimen of **Whewell's Anemometer** (2880) is sent by Elliott Brothers.

By far the most elaborate apparatus is **Dr. Von Oettingen's "Self-**

* For engraving and description, see *Met. Mag.*, Vol. II., p. 123.

† Registering refers to the placing of an index as in a minimum thermometer, or the hands as on a gas meter ; recording implies the production of a record upon paper.

recording Wind Components Integrator," of which the following is the description in the 2nd edition of the Catalogue.

"The wind moves a system of hemispherical cups, like Robinson's, acting on a circular plate whose velocity is ordinarily proportional to the velocity of the wind. Four systems of sliding rollers rest on this plate, whose bearings can be moved round a vertical axis, the principal planes of which imitate all variations of a wind vane. Each sliding roller can rotate about a horizontal axis, but only in one direction, and after a half rotation an electrical contact is made. A mechanism limits the contact to a fraction of a second. When the contact is made, one of four wheels, with number-types, is moved. Every half an hour the position of these four wheels is shown by printing numbers on a strip of paper. The differences of those readings represent the mean velocity of the wind from N., E., S., and W. They are converted into absolute values by means of a table. Different mechanism adjusts the portion [? position, *Ed.*] of every sliding roller."

We do not understand this description, though it is less bewildering than that in the 1st edition of the Catalogue. Possibly we may be favoured by some one who has mastered the intricate construction of this instrument with a clear description, but failing that, and subject to correction, we may state that the impression left upon our mind is that it is a combination of a recording velocity anemometer and a Babbage's calculating machine—*i.e.*, that while the original mechanical arrangements indicate velocity and direction, the instrument is so designed that the record is given in N.-S. and E.-W. components, similar to the results which would be given by the application to the ordinary records of Lambert's formula. As, however, neither vane nor set of cups is attached, and the parts of the apparatus do not seem to be in position, it is quite possible that the above inference is wholly erroneous.

RAIN GAUGES.

Most of the rain gauges exhibited are of patterns familiar to nearly all the readers of these pages. We, therefore, pass at once to the novelties.

Stutter's Self-recording Rain Gauge is exhibited by the patentee and manufacturer, Mr. Hicks, but for some unknown reason it is not to be found in the catalogue. However, we, instead of passing it over, engrave it, and reprint the maker's description, with merely a few verbal alterations.

"The importance of *Self-recording* instruments in yielding *continuous* records of Meteorological changes is now fully recognized; their cost has, however, hitherto prevented their general use. The rain-gauge here described is a step in the direction of cheapness without sacrificing efficiency. Fig. 25 represents the instrument with its cover and receiving funnel taken off.

"It is made in two forms, one with 12 and the other with 24 compartments.

"In the centre is an eight-day clock with its upright spindle, bearing a small funnel with a horizontal tube which revolves once in 12 or 24 hours, the end passing successively over the mouths of the 12 or 24 compartments on the rim of the instrument. Beneath each compartment, which is funnel-shaped, is placed a tubular glass jar, as shown in Fig. 26.

"The rain is received by the outer funnel (Fig. 26), drips into the smaller revolving funnel, and running along the horizontal tube falls into the compartment corresponding to the hour of the day. So that all rain falling, for example, between two and three o'clock will be found in the tube marked 2.

In taking an observation the dome is taken off, the inner ring, with its 12 or 24 divisions is lifted out and each tube inspected, those that contain rain are lifted out and their contents poured separately into the one *graduated* tube supplied with each instrument, read off in hundredths of an inch and noted against the hour.

Each tube (Fig. 26) can contain half-an-inch of rain. Any overflow runs into a vessel beneath, and can be measured, the tube which has overflown shows the hour.

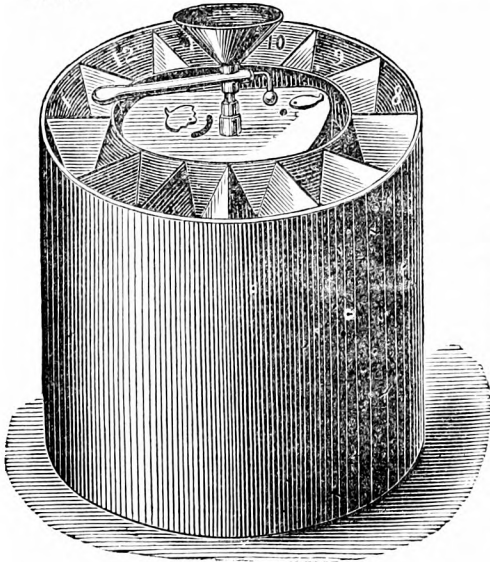


Fig. 25.
SCALE ABOUT 1-7TH.

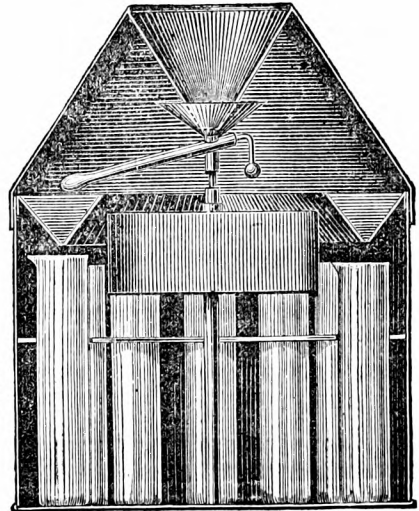


Fig. 26.
SCALE ABOUT 1-7TH.

Not having tried the instrument, we cannot speak decisively respecting its merits. But there are a few remarks which can be made with safety. In the first place we admit that self-recording instruments must be made at lower prices than previously, or they cannot be so generally used as is desirable. Mr. Hicks charges, we believe, about six times as much for a Beckley's rain gauge as for a Stutter's—so far so good, very good in fact.

The general arrangement may be regarded as satisfactory, except that it wants a Snowdon rim, the instrument is not too tall, and will, therefore, collect the true amount of rain, and its broad base will prevent its being overturned. We see several objections to the instrument as exhibited at South Kensington, but we see also how they may be met without greatly increasing the cost, and we make Mr. Hicks a present of the suggestions.

(1) It is a pity that the jars only hold 0.50 inch, and quite possible for more than half-an-inch to fall in two hours out of 24; in that case the overflow could not be properly apportioned.—Remedy: Let each glass stand in an open topped cylinder, having a capacity of $1\frac{1}{2}$ to 2 in., double overflow would then be, in the highest degree, improbable.

(2) There must be some loss in the wetting of so many jars, and in pouring from them into the one graduated jar at present supplied.—

Remedy: Divide all the jars; this would cost a guinea or, perhaps, two extra, but the accuracy and convenience would be well worth the money.

(3) There seems liability to damage from rain getting into the clock while the cover is removed for the measurement and emptying of the tubes, and also loss of record while this emptying, &c., is in process.—Remedy: Provide a spare can which could be placed under the collecting funnel during this time, this would secure continuity of record, and then the gauge and clock could be examined under cover, either temporary (an umbrella) or otherwise.

(4) We are afraid that it will be troublesome in frosty weather. A night-light under the second funnel would be useful, but probably the rotating tube would freeze first, and if it were blocked all other arrangements would be futile. However, in this respect it is only like all other self-registering rain gauges.

HAIL STORMS—AN EXPLANATION NEEDED.

To the Editor of the Meteorological Magazine.

SIR,—I enclose a proposal for an insurance against hail, and you will see in the last paragraph that "All crops growing within twelve miles of Somersham railway station, Huntingdonshire, are charged double the usual rate," and this is the custom of all insurance companies. I shall be very glad if any of your correspondents can explain why there should be twice as many hail storms in that district as in any other district in England.

I think it is an interesting subject for meteorologists.

I am, yours faithfully,

A. S. LESLIE MELVILLE.

The Long Hills, Lincoln, Oct., 1876.

THREE WET AUTUMNS.

To the Editor of the Meteorological Magazine.

SIR,—It is a singular fact, and one worth recording, that in this locality we have now experienced three abnormally wet autumns in succession, and that in each case the duration of excessive rain has been identical, extending over nine weeks. Comparing the three periods, and the rainfall of each, we arrive at the following figures:—

					inches.
1876	...	Fall of 9 weeks,	Aug. 17th to Oct. 18th	...	13·968
1875	...	„	Sept. 19th to Nov. 20th	...	15·942
1874	...	„	Aug. 6th to Oct. 7th	...	13·521

The yield of these periods is (taken separately or collectively) considerably more than double the average quantity.

I am, Sir, your obedient servant,

W. F. DENNING, F.M.S.

*Tyndale House, Ashley Down, Bristol,
October 20th, 1876.*

JUNE AND OCTOBER.

To the Editor of the Meteorological Magazine.

SIR,—So many persons have the idea that the Undercliff, because it is comparatively warm in winter, is exceptionally hot in summer, that I take the liberty of enclosing the table of the temperature here for the first 19 days in October, compared with the first 19 of June, by which you will see that the latter was actually a cooler period than the former.

Although the average maximum for the two periods is practically the same, the average mean is higher in October, in consequence of the nights in October being warmer than the corresponding nights of June.

Yours very sincerely,

C. MALDEN.

*St. Lawrence Rectory, near Ventnor,
Oct. 21st, 1876.*

[As the daily entries are in nowise remarkable, unless it be for uniformity, we have only printed the means, and for the sake of comparison we have added the corresponding values for London, from a louver-boarded stand, such as, we believe, Mr. Malden uses.

		St. Lawrence.				London.	
		June 1-19.	Oct. 1-19.			June 1-19.	Oct. 1-19.
		deg.	deg.			deg.	deg.
Mean Max.	...	61·8	61·9	.....		65·8	64·4
„ Min.	...	50·8	56·7	.....		48·7	51·8
„	...	56·3	59·3	.....		57·3	58·1
Absolute Max.	...	70·1	64·6	.....		77·8	70·5
„ Min.	...	46·0	51·0	.....		40·1	40·1

The table shows two features at the same time, (1) that both at St. Lawrence and in London, the first 19 days, especially the nights, of October were warmer than those of June, and (2) it shows in a marked manner the diminished range of temperature on the south coast, viz., almost exactly one-third less than in London.—ED.]

REVIEWS.

Theorie eines neuen Thermometers, welches aus der Vereinigung des Luftthermometers mit dem Wagebarometer entsteht und sich zur automatischen Aufzeichnung der Temperaturen sehr leicht verwenden lässt. Von Dr. PAUL SCHREIBER. [From Carl's *Repertorium* Bd. XL.] Munich, 1875. 8vo.

DR. SCHREIBER begins by saying that the air thermometer is recognised as the best instrument for the estimation of temperature, and that it has the great advantage over the mercurial thermometer that the observations can be made elsewhere than in the position of the instrument. Although to a slight extent we disagree with both portions of the above statement, we object chiefly to the second part. We believe that if an air thermometer is made to act through a length of tube, its

indications are sure to be vitiated in exactly the same way as were those of the old fashioned underground thermometers.

No specimen of the instrument had been made when the pamphlet was written, and we can therefore only state briefly the proposal as we gather it from the letter-press and the plate; the former, we may mention, occupies 40 pages, but a large proportion of the space is devoted to the mathematical investigation of the probable corrections.

The proposal involves five distinct parts :—

- (I.) A balance barometer with recording cylinder.
- (II.) An air-baro-thermometer which consists of another balance barometer, with a small flexible tube leading out of the upper part, the other end of which tube terminates in a hollow metal sphere exposed to the external air.
- (III.) A similar air-baro-thermometer for showing the temperature of the internal parts of the apparatus.
- (IV.) An electric battery with three induction coils.
- (V.) A clock for regulating the transmission of the induced currents.

To parts (I.), (IV.) and (V.) we have no objection; but, to our regret, it appears to us that parts (II.) and (III.) are impracticable. We can apply no other term to a proposal that the upper part of a barometer tube should have a side tube inserted in it, to which a long flexible tube is to be attached. The entire accuracy of the apparatus depends upon the possibility of keeping these connections absolutely air-tight, which we believe to be impracticable for any length of time.

Under these circumstances we do not think it necessary to consider other objections, such as that the indications of the air-baro-thermometer must have as their base-line the variable indications of the balance barometer, and the complicated corrections which would be necessary. It also seems to us that there would be serious difficulties in the construction, and therefore, while admitting the ingenuity of the design and the skill shown in some parts of the treatment of the theory of the instrument, we feel bound to wait for the completion of a specimen before pronouncing a verdict in its favour.

Commission de Météorologie de Lyon. 1873 Trentième année. Lyon, Pitrat Ainé, 1875.

It is some years since we have had the pleasure of noting the appearance of the reports of the Lyons Commission, but we find this body as active in the thirtieth year of its existence as in the earliest of which we have any record. It will be remembered that we mentioned, at the time, the great loss which the Commission sustained in the death of its former President, M. Fournet. We think that both Meteorology and the City of Lyons have reason to be glad that Professor Lafon now occupies the presidential chair.

The principal features which strike us as improvements in the present

volume are, (1) the placing of the meteorological curves for each month opposite the numerical tables, so that all can be compared with great facility ; (2) the insertion of a list of errata—we always distrust publications which make light of human fallibility ; and (3) the detailed chronicle of atmospheric changes, which is very well done.

We think that it would be very convenient if one or two pages, in each annual volume, were devoted to giving the total rainfall at some (or all) of the stations of the Commission in each year, from the commencement of the observations. And if we may be allowed to make two suggestions in one year, the second will be that a skeleton map of the basins of the Rhone and Saone, with the hydrometric stations of the Commission distinctly marked and also the mountains and principal water courses, would be a very handy addition to the already excellent volumes.

L'Orage du 7 au 8 Juillet, 1875. [Extrait du Journal de Genève, du 9 au 12 Juillet.] Genève : RAMBOZ ET SCHUCHARDT, 1875. 8vo.

FEW hailstorms have been as destructive as those which occurred at the southern end of the lake of Geneva soon after midnight of July 7th–8th, 1875. It is, therefore, fortunate that a very complete record of the phenomenon was prepared and published (at the small price of 30 centimes). The pamphlet occupies 40 pages, and contains a map giving the boundaries of the districts principally injured.

The premonitions of the storm are thus described :—

“Wednesday, July 7th, the weather was particularly sultry. A heavy heat, the enervating effect of which was untempered by the least breath of air, produced in every one unusual lassitude. The air was charged with vapour, and the least details of the mountains were visible ; they seemed as if one could touch them. Soon after noon threatening clouds formed on the top of the Jura, and the sun at its setting bathed its sides in a tawny light. The evening was calm, but a little after 10 p.m. an electric storm broke out with extraordinary intensity, but without a single clap of thunder. From 10.30 to 11.30 the flashes were so frequent that one could see as in broad day-light, and one might consider the town wrapped in a sheet of flame. Although the heat continued stifling, and there was not a breath of air on the pavements, yet after 11 p.m. all the little objects upon the roofs began to spin round as if driven by a tempest. At the same time a hollow rolling sound, which was neither that of wind nor that of thunder, announced the approach of the terrible phenomenon which, at midnight, broke upon Geneva with all its fury.

“An avalanche of enormous hailstones, without any trace of rain, was discharged, driven by the S.W. wind upon the roofs and walls of the houses, and against the windows, whence they rebounded with an indescribable clatter. Those windows which were not protected by external shutters, no matter how thick the glass, were smashed into into fragments. In the twinkle of an eye almost all the street lamps

were extinguished, and the only light of the town was that of the lightning reflected as from a sheet of ice. All the glass roofs (so numerous in the new part of the town) have been pulverized, and scattered over the staircases they were intended to protect. Such has been especially the case with our printing office [*Journal de Genève*], of which the double glass roof was broken in and scattered over our presses at the very moment when we were preparing for publication.

"It was unfortunately the same with the glass roof of the Rath Museum, whose windows have been reduced to dust. Twenty-two paintings have been more or less damaged, some of them slightly, several pierced with holes as large as a fist. The exhibition of the pupils of the Schools of Design was entirely destroyed by the hail, rain, and fragments of glass."

The destruction of the vintage and various crops is then stated, and appears to have been more or less serious over an area of about 250 square miles.

As the meteorological details are more essential for these pages than the social or statistical, we pass over all the details of disasters in the country with the following exception—"On these last two points (Annemasse and the hill of Monthoux) the violence of the tempest exceeded anything previously known. Not only is the country completely cleared, but there hardly remains a tile upon the roofs."

"Persons worthy of trust assure us that at Annemasse hailstones fell weighing 1 lb. 12 oz. This almost incredible fact is stated to us upon such good authority that we are obliged to admit it. Moreover, we have ourselves seen the sketch of hailstones, picked up at Pinchat, after lying in the sun and rain for a whole day, and which were still nearly 3 inches in diameter. The stones were generally of a lenticular or nearly spherical shape; their structure was usually a central opaque nucleus, surrounded by a radiated and semi-transparent exterior. These masses of ice, driven almost horizontally by the S.W. wind, were discharged with almost resistless violence on all obstacles which barred their passage. We are informed that, at Annemasse, one of these hailstones pierced a solid wooden shutter, broke the window, and subsequently had sufficient force to star a mirror.

We may mention some facts worthy the attention of meteorologists.

"(1) During the whole of the day preceding the storm the, as yet unexplained, phenomenon, known as *ladières*, was seen on the surface of the lake. They are currents which manifest themselves suddenly without apparent cause, in one direction or another, and whose influence is felt upon the boats. We do not know what is the value of this indication, nor even if it has any connection with the storm of the night; but everything bearing in the least on the disorder of the elements is worthy the attention of meteorologists. (2) In the evening, a little before sunset, two clouds of unusual form were observed in the S.W. One of these was like an immense cone whose base was lost in the sky, while its slightly truncated summit touched the earth. The rays of the setting sun striking obliquely upon this mass of vapour,

gave it a lovely violet colour. The other cloud was more irregular : the upper part formed an enormous udder-shaped mass, connected at the base by a sort of strangulation.—[Probably the Orcadian Pocky Cloud. Ed.] (3) A little after sunset a singular red glimmer, which has been compared to that of an aurora borealis, was seen near the N.W. horizon."

We have before us a fragment of the glazing of the printing office of the *Journal de Genève*. It is a sheet of glass 0·11 in. thick, pierced in its centre with a slightly elliptical hole, as cleanly cut and as regular as if done with a diamond and a pair of compasses ; the lesser diameter is 2·64 inches, and the greater 2·76 inches. One may notice all round, an elongated ellipse in which the glass has lost its transparency, and seems divided into a series of very close and regular concentric ellipses.*

We ought also to mention the frequency of the singular fact of trees being entirely stripped of their bark.

Prof. Colladon, in his report to the *Académie des Sciences de Paris*, states that the most usual size of the hailstones was $\frac{3}{4}$ in. in diameter, but that they reached nearly 4 inches in rare cases ; they all had an opaque nucleus about $\frac{1}{4}$ in. in diameter, surrounded by alternate layers (usually six to eight) of clear and opaque ice. The large hailstones were mostly flattened, and these lenticular stones were evidently not broken fragments of larger ones.

Prof. Colladon believed that the path, and greatest intensity of the storm, were influenced by the river Arve.

It is fortunate that both a self-recording barometer and thermometer were at work at Geneva, and that neither was injured. The following is the account of the results as given by M. Grosclaude :—

The barometer, after a slightly disturbed course, rose suddenly 0·39 in. in half-an-hour, between 0.15 and 0.45 a.m. During storms it generally rises, but rarely so suddenly as in this instance. After 0.45 a.m. it resumed the fall which lasted uninterruptedly throughout the next day.

Still more remarkable were the thermometer changes. After a perfectly natural decline of temperature up to 0.15 a.m., when it was 72°·9, it fell suddenly to 61°·9, that is to say, 11°·8 in a quarter-of-an-hour. Half-an-hour later it had risen to 63°·5, at which it remained until the morning.

We may add that Dr. Metcalf, of Geneva, to whom we are indebted for our copy of the pamphlet, informed us that he himself saw stones which after lying for four days in sun and rain were the size of large walnuts. He considers that at Geneva the average size was about 2 inches diameter by half-an-inch thick.

* This is, or was, (No. 2912) in the Loan Exhibition of Scientific Apparatus,

OCTOBER, 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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.			
				Dpth	Date.		Deg.	Date.	Deg.	Date.		
I.	Camden Town	inches 1.40	inches. — 1.19	in. .43	12	14	71.2	6	34.2	31	0	2
II.	Maidstone (Linton Park).....	1.32	— 1.78	.38	1	19	72.0	6	35.0	31	0	...
III.	Selborne (The Wakes).....	2.11	— 2.10	.56	9	15	66.5	5,19	30.0	25*	2	4
IV.	Hitchen .....	.97	— 1.58	.25	6	14	64.0	7	28.0	31	2	...
V.	Banbury	1.39	— 1.04	.45	3	14	69.0	7	32.0	31	1	...
VI.	Bury St. Edmunds (Culford).....	.84	— 1.87	.26	12	12	70.0	7	31.0	31	2	2
VII.	Norwich (Sprowston) .....	...	...	...	...	...	...	...	...	...	...	...
VIII.	Bridport	2.27	— 1.76	.46	17	17	73.0	3	32.0	30	...	...
IX.	Barnstaple	3.58	— .54	.75	17	15	70.0	4	46.0	16†	0	...
X.	Bodmin	3.97	— 1.35	.74	16	18	64.0	4	38.0	29	0	0
XI.	Cirencester	1.46	— 2.03	.24	6	14	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall)	2.81	+ .57	1.55	8	16	65.0	4,6	32.0	31	1	2
XIII.	Tenbury (Orleton)	2.29	— .94	.62	8	19	68.5	5	34.2	30	0	3
XIV.	Leicester (Belmont Villas)	1.55	...	.43	3	14	70.2	7	35.0	31	0	...
XV.	Boston	1.17	— .95	.34	6	12	68.0	5	34.0	31	0	...
XVI.	Grimsby (Killingholme)	1.85	...	.48	6	12	66.5	7	35.0	31	0	...
XVII.	Mansfield	2.28	...	.75	8	21	68.0	7	32.6	31	0	...
XVIII.	Manchester	2.60	— 1.21	1.45	8	11	72.0	19	28.0	31	1	1
XIX.	York	2.47	— .05	1.15	8	13	66.5	7	31.5	30	1	...
XX.	Skipton (Arncliffe)	3.91	— 2.75	.73	8	17	65.0	7	29.0	25	4	...
XXI.	North Shields	1.78	— 1.50	.45	8	14	65.0	7	34.0	31	0	0
XXII.	Borrowdale (Seathwaite).....	7.32	— 9.00	1.63	11	15	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	7.38	+ 2.19	1.85	8	17	65.5	3,5	31.5	31	1	1
XXV.	Machynlleth	5.49	...	1.77	8	16	71.0	6	25.0	31	3	...
XXVI.	Llandudno	3.07	— .89	.53	17	15	66.3	5	41.4	23	0	...
XXVII.	Dumfries (Crichton Asylum).....	4.48	— .69	1.10	10	15	62.8	7	28.4	31	1	2
XXVIII.	Hawick (Silverbut Hall).....	2.66	...	.40	12	16	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill).....	6.70	...	1.34	11	16	64.3	5	30.1	31	1	3
XXX.	Castle Toward	6.58	+ .83	1.37	19	18	59.0	7,8	27.0	31	1	...
XXXI.	Mull (Quinish) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	5.19	...	.85	8	14	...	...	...	...	...	...
XXXIV.	Braemar	3.53	+ .78	.67	10	18	59.8	7	33.2	30	0	3
XXXV.	Aberdeen	2.64	...	.53	13	23	61.2	8	35.4	31	0	5
XXXVI.	Loch Broom	3.70	...	.86	18	18	...	...	...	...	...	...
XXXVII.	Portree	8.13	— 2.65	1.33	10	21	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	2.53	— .13	.66	12	14	65.6	6	30.5	22	1	6
XXXIX.	Helmsdale	3.46	...	1.12	13	18	...	...	...	...	...	...
XL.	Sandwick	3.80	— 1.12	.85	13	23	61.6	7	34.6	30	0	0
XLI.	Caherciveen Darrynane Abbey	5.35	...	.95	2	19	...	...	...	...	...	...
XLII.	Cork	6.88	...	1.23	2	14	...	...	...	...	...	...
XLIII.	Waterford	7.02	+ 2.62	1.31	15	20	64.0	3	32.0	24	1	...
XLIV.	Killaloe	4.52	— .50	1.04	15	16	73.0	7	33.0	24	0	...
XLV.	Portarlington	2.91	— 2.22	.47	11	24	65.0	7	31.0	23	1	...
XLVI.	Monkstown, Dublin	5.00	+ 1.08	.72	18	16	...	...	...	...	...	...
XLVII.	Galway	4.63	...	.93	14	19	65.0	7	32.0	23*	2	...
XLVIII.	Ballyshannon	3.86	...	.90	8	15	...	...	...	...	...	...
XLIX.	Waringstown	4.65	...	.79	2	19	67.0	7	37.0	30	0	0
L.	Edenfel (Omagh)	4.48	...	1.03	2	17	62.0	6,7	27.0	31	1	0

* And 31.

† 29.

† Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON OCTOBER.

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.—The first fortnight showery, and heavy rains not uncommon; after that time dry and fine, though mostly dull until the last few days, when it became brighter, and the unusual sight of dust flying in October presented itself. Bar. mostly high. On the whole a fine month, and the latter part of it especially so; drier than any preceding October I have on record. No frost to do any harm except on the last morning of the month.

SELBORNE.—TS on 5th; T on 6th; dense fogs on 8th and 19th; fogs frequent after the 17th; frost on the grass on 15th; white frost on 25th, and mist on the Hanger. Bar. remarkably even the latter part of October and beginning of November, from the 24th October to this day (November 6th) the total variation has not exceeded .15 in., viz., 29.80 in. to 29.65 in. (uncorrected) in 13 days. Prevailing wind up to 20th, S.W., after that date, variable. [Erratum.—In September Remarks, for "greatly retarded" vegetation read "cultivation" vegetation was exceptionally profuse.

BANBURY.—T and L on 6th.

CULFORD.—The latter half of the month remarkably fine, no R having fallen between the 14th and 31st. Mean temp. above the average, viz., 52°·6; max. 70°; min. 31°; a great prevalence of southerly winds; polar winds prevailing only on five days. A great depression in temp. set in on the 31st, the max. only reaching 44°.

BODMIN.—Rainfall 0.87 in. above the average of 27 years. Mean temp. of the month, 48°·3.

SHIFNAL.—The copious rains with which September closed continued with more or less persistence till the 19th of October, the only exceptions being the 1st, 10th and 14th. The fall on the 8th (1.55 in.) was most extraordinary, falling as it did in 21 hours, and without any symptoms of T. From the 18th a dry spell set in, accompanied by easterly winds, most acceptable to the farmers for drying the saturated earth. The mistiness that prevailed through the greater part of the month was most unusual, no less than 14 days being so affected. A high wind on the 11th was the only one in the month. Dahlias, &c., remained unscathed till the close, the only frost being on the 31st, and the average min. being as high as 45°·2. Ring dove still cooing; on 4th large dragon fly still hawks about on 6th.

ORLETON.—Very cloudy, damp and warm, with R every day till the 19th, but generally in small quantities; the wind then changed from S.W. to N.E., and the remainder of the month was dry and pleasant, but much cooler and very favourable for wheat planting. The mean temp. of the month was about 2¼° above the average. The wind was great on 1st, 9th and 11th; on the latter day the bar. fell to a low point. The river Teme overflowed its banks on the 9th. No T heard.

LEICESTER.—A mild and fine month; the max. temp. was very high at the beginning of the month, rising to 70° on 5th, 6th, and 7th, and being never below 60° (with one exception) from 3rd to 19th; the night temp. very high, especially during the first week; only .03 of R fell after the 12th; L on morning of 14th. Mean max. 59°; mean min. 47°·7; mean of month 52°·6; mean of 1st to 19th, 56°.

BOSTON.—A very fine month; mean temp. 3° above the average. Rainfall 1.14 in. below the average of the previous 20 years. The dry weather has been of immense advantage to the lands after the very heavy rainfall of the previous month.

GRIMSBY.—A very fine month, with many pleasant days; a good deal of fog; the last day quite wintry. Last year the fine, dry weather broke up on October 9th, when the bar. fell with a N. wind. This year the rain ceased and dry weather set in at the same date. L at 8 p.m. on 14th; T at 10 a.m. on 17th.

MANSFIELD.—The month commenced with a continuation of the September weather; dull and showery R falling, more or less, every day; this was followed

by genial weather ; R falling chiefly at night ; then followed some damp, raw, November-like weather—foggy and gloomy, but the month closed with beautiful calm, bright, sunny days. 11th, very stormy and bright night.

MANCHESTER.—A very dry October, R falling upon 11 days only. The total fall (2·60 in.) is more than 1 in. below the average, and more than half of this fell in one day (the 8th).

ARNCLIFFE.—Thirteen consecutive days (19th to 31st, inclusive) gave only ·01 of R—most unusual.

NORTH SHIELDS.—Distant lunar halo on 6th ; distant solar halo on 8th ; TS on 9th.

WALES.

HAVERFORDWEST.—The first nineteen days excessively wet, and at times very wild ; T with vivid L on 8th, and again on the evening of the 11th, with a terrible storm of hail. A change took place after the 19th, when the weather became clear, calm and cold, the first half of the month having been characterized by excess of temp., especially high at nights, fourteen of which were 50° and upwards. Wind easterly from 16th to 31st.

MACHYNLLETH.—A very wet month up to the 18th ; temp. rather high ; very close, warm and muggy up to that time. L at night on 11th and 17th ; very fine and dry from 18th to the end.

LLANDUDNO.—The temp. of the month about 1°·5 above the average ; nevertheless, the sky was more than usually cloudy, and much haze prevailed during the latter half of the month. No R fell during the last twelve days, and the total fall was considerably below the average.

SCOTLAND.

DUMFRIES.—Upwards of 1·00 in. R fell on the 10th ; it was preceded by T and H, and followed by a heavy gale of wind from S.W. Latter part of month dry and fine ; mean temp. 50°·2, being 3° higher than last year ; sharp frost on 31st.

HAWICK.—Excepting the four days, 9th to 12th, inclusive (which were very windy), the month has been very mild ; scarce any bright sun during the month.

ANNANHILL.—Temp. 2°·1 lower than last month ; winds moderate, except in the middle of the month ; hard gale from W.S.W. on 10th and 11th, with T and L ; H and heavy R ; 1·20 in. fell between 9 a.m. and 4 p.m. This heavy R was followed by a brilliant double rainbow in E.N.E. An especially heavy squall of wind about 4 p.m. on 11th ; frequent fogs and much cloud ; TS on 10th, 11th and 14th. Death-rate at the rate of 21 per 1,000 ; principal causes, consumption and bronchitis.

BRAEMAR.—A very wet, damp month ; crops much damaged. T and L at 5.30 p.m. on 11th.

ABERDEEN.—A mild but most unseasonable month ; ruinous to the crops, still out when it commenced ; bar. pressure and temp. above the average, the rainfall below it. L on 10th and 11th ; S on 30th and 31st.

LOCHBOOM.—A peculiarly mixed month—all sorts of weather, but on the whole good and favourable, particularly the latter, for the lifting the potatoes, which are exceedingly good in this part, and quite free of taint : that, with the ample supply of herrings got here, make a good prospect for the poor.

PORTREE.—First two days dry, thence to 18th very wet and stormy, after that date moderately fine to the end, which enabled the ingathering of the last of the crops to be effected in pretty good order. Potatoes sadly diseased. Rainfall considerably below the average of the last 16 years ; a number of shooting stars on 25th, direction from S.E. to W. ; ground covered with S on morning of 15th ; H showers on 10th ; Heavy gale on 16th.

CULLODEN.—Last swallow seen on the 1st ; sprinkle of S on Ben Wyvis, in Ross-shire (3,422 ft. high), on 2nd ; slight showers of S and sleet on 30th and 31st.

SANDWICK.—October has been cloudy, hazy, wet, and very unfavourable for cutting and taking in the cereal crops. Bar. fell to 28·48 in. at midnight on the 11th, and two hours after there was a gale of 65 miles an hour from 2 to 3 a.m. on 12th. There was also a long continued gale from the morning of 29th till

noon on 31st, from 40 to 60 miles an hour. T on 11th; aurora on 6th; lunar rainbow on 7th; Hoy Hill white with S on 31st.

IRELAND.

DARRYNANE.—First half of month, westerly winds and unsettled weather; second half, easterly winds, fine weather, and mild. T and L on 10th and 15th.

KILLALOE.—Remarkably fine autumn weather from 19th to end of the month, with sharp frost on the last night.

MONKSTOWN.—The early and middle part of the month mild and wet, the latter part fine and dry, cooler, but not cold; no frost. Bar. very high and steady.

BALLYSHANNON.—The month has been unusually mild, and very favourable to the completion of harvest work. In the early part of the month there were some heavy falls of R, but as they were of short duration they did not interfere with the farmers. Rainfall '68 in. less than the corresponding period of last year.

WARINGSTOWN.—Very wet until the last week, but warm and genial; no frost.

OMAGH.—Weather very wet and unsettled, though mild, up to the 19th; thence to the end of the month remarkably fine, balmy, and summer-like. No frost, except on the last day; the fruit and foliage of the forest trees having been allowed to ripen and mature without the interference of frost, the autumn tints have been beautiful beyond recollection.

SUPPLEMENTARY TABLE OF RAINFALL IN OCT., 1876.

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

Station.	Total Rain. in.	Station.	Total Rain. in.
Acol	·85	Llanfrechfa	4·90
Hailsham	1·57	Castle Malgwyn	5·86
Andover	·55	Heyope .....	...
Strathfield Turgiss	1·83	Rhug, Corwen	4·48
Addington Manor	1·34	Port Madoc	6·05
Oxford	1·02	Melrose	2·75
Cambridge	1·04	Cessnock, Glasgow	6·40
Sheering	1·24	Gruinart	7·02
Ipswich	1·15	Keith	2·83
Diss	·90	Strathconan .....	...
Swaffham	·84	Springfield, Tain	2·95
Compton Bassett	1·65	Skibbereen	4·39
Dartmoor	7·61	Glenville, Fermoy	6·34
Teignmouth	4·21	Tralee	4·15
Torrington (Langtree) ..	4·23	Newcastle W., Limerick ..	3·38
Trevarrick, St. Austell..	4·71	Kilrush	2·38
Taunton	2·90	Kilkenny	4·82
Bristol	3·20	Kilsallaghan	5·45
Sansaw	2·76	Twyford, Athlone	5·27
Cheadle	3·38	Ballinasloe	4·33
Ashby-de-la-Zouch .....	...	Kylemore	9·66
Coston, Melton Mowbray ..	1·39	Bangor .....	...
Bucknall	1·45	Carrick on Shannon	4·38
Walton, Liverpool	2·66	Rockcorry	3·67
Broughton-in-Furness ..	4·26	Warrenpoint	6·10
Stanley, Wakefield	2·11	Bushmills	4·44
Gainford	1·69	Buncrana	4·12
Shap	5·05		

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CXXXI.]

DECEMBER, 1876. [PRICE FOURPENCE
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SCIENCE AT SOUTH KENSINGTON.

(Continued from page 143).

RAIN GAUGES (continued).

THE most important is the **Electrical Self-Registering Rain Gauge** (2852*g*), sent by Yeates and Son, of Dublin, represented by the *frontispiece*. It consists of three parts, (1) a rain gauge, (2) a battery, and (3) a registering apparatus. The rain gauge may be best described as an improved Crosley's, the battery is of a simple and lasting form, and the recording apparatus is also simple and elegant in appearance.

As to the luxuriousness of the arrangement there is no question; it is very tempting, and we see no reason to doubt its being as accurate as it is elegant, but not having worked it, we cannot speak from experience. We should prefer a circular aperture to the rain gauge, but that of course is as easily made as a square one, and, doubtless, the makers supply either. The rain passes alternately into the right and left half of the tipping bucket, which tips over as soon as 0.01 in. of rain has fallen, and each time it tips contact is made, and the indicator carried forward one division. The principal objections to this mode of recording are—(1) that sometimes the rain falls so fast that a perceptible amount is lost during the change from one bucket to the other, (2) that the tipping parts of the apparatus become rusty and sluggish through the continued damp. Messrs. Yeates have adopted a new form of bucket, which they state “will register correctly, no matter at what rate the rain may fall.” As to rust and failure of record through defective contact, we, having had no experience, can only say that it is evidently very easy to clean the inside if and when necessary.

The advantages are numerous and obvious:—(1) the rain gauge can be put anywhere; one on the top of Skiddaw would record in Keswick or in London; it is mainly a question of telegraph wire; so with small distances, great advantage and comfort would often result from one being able to place the gauge in a garden or field, perhaps out of sight of one's residence, or separated from it by a public road; (2) the apparatus exposed to the weather is inexpensive and comparatively imperishable; (3) the battery can be placed anywhere, and the

recording apparatus would be an ornament to any study ; (4) it will evidently give most useful information as to the rate of heavy rains ; (5) it is also evident that the addition of a driving clock and paper-covered drum, with very slight alteration of the registering apparatus, would yield a continuous record, a fact which we commend to engineers.

HYGROMETERS.

THERE was no section of the exhibition more nearly complete than that of Hygrometers.

We have not been able to find the oldest one, which is thus described :—

2863. **Catgut Hygrometer**, dating from the first quarter of the 18th century. The property of His Highness the Prince of Pless.

Sub-Committee of Breslau.

Next to it in antiquity is probably that exhibited by the authorities of King's College, and which belongs to the Museum of George III. It (2871) is represented in fig. 27, and consists of a number of discs of thin paper (perhaps once saturated with salt) on a thread attached to the short end of a lever, the long end of which points to a higher or lower division on the scale, accordingly as the weight of the paper (by absorbing moisture from the air) increases or decreases. It appears to have been designed by John Coventry, and made by George Adams.

Three **Torsion Hygrometers** are exhibited, one (not in the catalogue) was made by Robinson, of Devonshire Street, Portland Place, formerly belonged to Captain Kater, is represented in fig. 28, and is lent by the Royal Society ; another is a **Whalebone Hygrometer** (2854), by Thomas Jones, of Oxendon Street ; and the third is an **Oatbeard Hygrometer** (2871a), by Casella. These last two are exhibited by Mr. G. J. Symons.

Saussure's Hair Hygrometers are shown in many forms. Dr. Henri de Saussure sends three original instruments, (2865) made by the inventor, and with tables in his own handwriting. An eight-haired one (2864), by Richer, of Paris, which was formerly the property of Mr. Francis Ronalds, and used by him at Kew Observatory in 1843, is exhibited by the Kew Committee. Another old one (2853), by V. F. Hausman, is exhibited by Mr. Symons. Three new specimens are exhibited, one (2784 as used in Russia), by the Meteorological Committee ; one (2871c) of Parisian construction, by Mr. Symons ; and one of the modified form (2867) adopted by the Geneva Association for constructing Scientific Instruments, is exhibited by that body.

Perhaps to this list we ought to add the following, but we are not certain of the mode of its construction :

2858. **Klinkerfues' Bifilar Hygrometer**, with reduction disc, executed by W. Lambrecht, Göttingen.

Professor Klinkerfues, Göttingen.

The bifilar hygrometer shows the relative dampness without further reduction,

upon a stereotyped scale of equal divisions, and also the dew point by means of the reduction disc.

The reduction discs for the psychrometer give likewise the dew point according to the following rule :—

The outer disc is turned round the inner one in such a manner that the two places of the evaporation temperatures, read off from the moist thermometer, coincide ; with the place of the air temperatures upon the one will then coincide the place of the dew point temperature upon the other. The one disc has yet a second division, which comes into use in case of the evaporation temperature falling below zero.

The barometric pressure is assumed to be 750 mm. ; for any other pressure, b , the quantity $\frac{3}{8}(b-750)$, taken in nearest round numbers, can be easily multiplied in the head by the thermometric difference, likewise taken in round numbers. The product expresses the number of hundredths of a degree, and has to be added to the air temperature, in order to obtain, after the setting of the disc, the dew point with greater precision. This correction is, however, seldom required in practice.

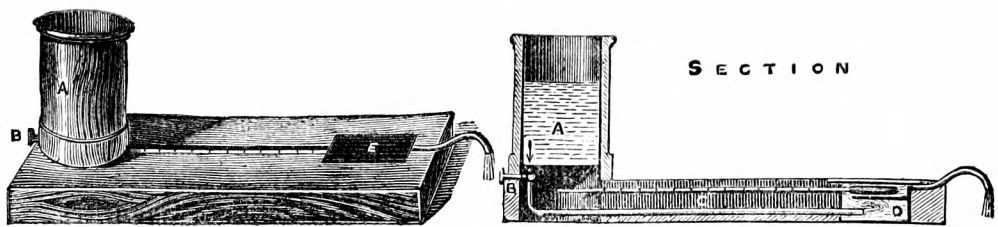
Of dew point instruments there are four patterns, two are tolerably well-known, viz., Daniell's and Dines's, but the others are rare, one from antiquity, the other from novelty.

The oldest is without name of inventor, maker, or owner, and is not catalogued—we, however, believe that it is the property of the Royal Society, it is represented in fig. 29. We should be glad if any of our readers can give its history. It appears to be an ordinary thermometer with a black glass bulb, surrounded by muslin so as to allow of its being cooled by ether being poured upon it, and, evidently, when the evaporation of the ether has cooled the bulb to the temperature of the dew point, the dullness deposited on the black glass will show it, and the thermometer scale will give the temperature. It seems to us by no means a bad instrument, and is extremely light and portable.

Daniell's Hygrometer (2855) is exhibited by Mr. G. J. Symons, who sends a specimen formerly belonging to Sir J. South, F.R.S. This instrument having been engraved and described in a previous number of this magazine*, nothing need be said respecting it.

Dines's Hygrometer (2871*f*) is exhibited by the maker, Mr. Casella. Its is, undoubtedly, the most delicate and the most easily controlled dew point hygrometer yet invented. The construction and the mode of use are as follows :—

A little water and ice, or cold water only, is put into the cup A, and allowed by the tap B to flow gently through the small chamber D, whence it rises through a perforated diaphragm into the space under the slab E. In this space, which is covered water-tight by a thin smooth piece of silver, or of black glass, rests the bulb of a sensitive thermometer, the water flowing gently from the spout, as shown, cools the cover E and the contained thermometer ; when the temperature reaches the dew-point, a strong film of vapour or dew will be visible, the temperature being shown on the graduated stem of the thermometer. The tap B enables the rate of flow of the water to be regulated with



accuracy, and the temperature of the water under E to be thereby kept at any required point.

The most novel hygrometer has by some vicissitude of fate been sent into the "heat" section, although catalogued under Meteorology. The entry is as follows:—

2868. **Hygrometer** modified by Dr. Geissler, with a delicate thermometer on a stand. *Will. Haak, Neuhaus am Rennweg, Thuringen.*

We have engraved this instrument in fig 30, but a full explanation is also indispensable. First there is a pillar carrying one ordinary thermometer, and one of the following intricate form. Starting from the top we find firstly an ordinary thermometer tube and its scale, then the tube is bent round and a double cylindrical bulb is formed, in the interstice of which is the mercury which forms the bulb of the thermometer, inside the cylinders are welded into one about half-way up, and thus the thermometer bulb is closed, then the cylinder is contracted to a tube and the tube ends in a hollow spherical bulb. Before closing this bulb, a little ether is poured through it and the tube into the cup of the inner cylinder of the thermometer bulb. Muslin is tied over the terminal bulb, and then the action is evidently as follows:— Drop ether on the muslin, its evaporation will cool that bulb, the ether in the thermometer-bulb-cylinder will evaporate and also cool, thus the temperature of the double cylindrical bulb will cool until dew is deposited on its surface, and then the temperature can be read off at once. Not having tried the instrument, we cannot speak positively as to its merits, but they appear to us to be very great.

August's Psychrometer, alias Mason's Hygrometer, alias Dry and Wet Bulb Thermometers, are exhibited in great variety. Large and fine ones are sent by Negretti, Casella, Hicks, and Pastorelli; good foreign ones are exhibited by Warmbrun, Quiltz & Co., by Haak, and by Geissler. Small portable ones are exhibited by Mr. Symons (an old one 2871b), and also by Casella and Pastorelli.

Prof. Buys Ballot exhibits (2856) a drawing and parts of a chemical balance hygrometer.

EVAPORATION MEASURERS.

We cannot pretend to classify these instruments, we do not believe that any of them can give even approximately accurate results, and we shall therefore pass them in review as rapidly as possible.

2789d. Lamont's Atmometer.

Meteorological Office.

In this instrument about a wine glassful of water is exposed in a metal dish, about 3 inches in diameter and less than an inch deep, it is to be observed under cover (because rain would splash out), and we believe it is also to be protected from the sun. Whether it is exposed to the sun or not, it cannot be accurate, because if exposed, the small quantity of water would heat up enormously beyond any natural water surface, and if sheltered, the influence of sunshine would be excluded.

2897. Evaporimeter, in the form of a spring steel-yard.

Professor F. Osnaghi, Meteorological Central Institute, Vienna.

This instrument shows on a sector the number of millimeters evaporated from a certain quantity of water in a given time. As its action is produced by gravity, it is also useful in winter, when ice is formed on the scale. It differs from other steelyards in the weight acting on the inner end of a spiral spring.

The term "steel-yard" in the above description is rather misleading, the instrument really consists of an evaporating dish 5 inches in diameter, supported by a rod which rests upon the inner end of a spiral spring. The decrease of the weight of water by evaporation releases the spring and causes an indicating hand to show the diminution upon a graduated arc. This instrument is open to all the objections urged against Lamont's.

2898. Apparatus for determining the Evaporation from different soils.

Sydney B. J. Skertchly, F.G.S., H.M. Geological Survey.

The apparatus consists essentially of an evaporimeter composed of two vessels, the innermost of which receives the material to be experimented upon, and the external one supplies water to compensate for evaporation. Over this is a glass vessel which receives the vapour given off by the material. The temperature, &c., are registered by a hygrometer and barometer in the glass receiver, and the temperature of the soil by a ground thermometer. Any given temperature can be obtained by means of a platinum spiral heated by a galvanic battery. The evaporimeter maintains the material in a natural condition so far as regards temperature and moisture. Dry air is admitted into the glass receiver, and the air with the evaporated water passes from the top of the receiver into a train of drying tubes; the current of air being produced by an aspirator containing oil. By means of this apparatus various soils, &c., can be brought under similar conditions of temperature, &c., and the evaporations compared for any temperature. The apparatus was especially designed to determine the proper amount of water which should be discharged by the artificial drainage system of the Fen Land.

The object of this instrument being fully stated in the above paragraph, we need say little respecting it. In fact, perhaps, the less we say the better.

2901. Ebermayer's Evaporation Apparatus, for determining the degree of evaporation from different kinds of soil.

Professor Ebermayer, Aschaffenburg.

This consists of a zinc box about 1 foot square and 4 inches deep, with a perforated tray at the bottom, adjoining this square box (which is to be filled with soil) is a cylinder 5 inches in diameter, and nearly a foot high (therefore overtopping the box by about 8 inches), which

is to hold a reserve of water. The general excellence of Prof. Ebermayer's work as indicated by his publication*, renders us inclined to mistrust our own opinion when it differs from his. Nevertheless, we must point out the respects in which his arrangements seem to us open to criticism. First then, Is it likely that the evaporation from a layer of soil only four or five inches deep will represent even approximately that of soil *in situ*, and in capillary connection with that beneath it to an unknown depth? Secondly, Is the apparatus to be under cover or not? All our previous remarks upon this point respecting Lamont's instrument apply here, and in addition, there is the fact that the super-elevation of the water-store cylinder would prevent rain reaching the soil, and cause other less important evils. Thirdly, the water in this store cistern would get very hot, and thus the soil would be saturated with water much warmer than would soil naturally circumstanced.

2902. **Morgenstern's Atmometer.**

W. Apel, Göttingen.

Morgenstern's atmometer differs from every other by its being founded on the principles of capillarity and of Mariotte's bottle.

The evaporating vessel is filled with siliceous sand, below which there may be placed a flat stone. This sand is saturated with water by capillarity; any loss of water by evaporation is at once replaced by a corresponding volume of water from a burette. This burette forms a Mariotte's bottle, the upper part of which is closed against the outer air by means of mercury. A tube, which dips into the sand and enters the burette from below, conducts air into the latter in proportion as water is lost through evaporation. When a large portion of the burette has become filled with air, the danger arises that the air column on expanding, by a possible rise of temperature, would exert a pressure upon the water below it in the burette, and thus lead to an over-saturation of the sand. To prevent this, the small globular vessel is provided, which is also connected by a small tube with the burette, and into which the water, pushed on by the expansion of the air column, enters. With progressing evaporation this water returns again into the burette or can later be drawn into the burette. This globular vessel is further intended for the filling of the burette with water, which purpose is accomplished by fixing an india-rubber tube, dipping into water to the open end, and sucking at the upper end of the pipette. Before the burette is completely filled the india-rubber tube is removed, and the sucking at the upper end of the burette resumed, when, in consequence, the globular vessel is emptied. The connexion of the burette with the sand is closed during the operation of filling.

The evaporating vessel has a surface area of one square decimetre ($4\frac{1}{2}$ inches diameter).

To exclude, as much as possible, the influence of the temperature, the evaporating vessel is enveloped in some bad conducting material.

The sensitiveness of the instrument is so great that a little dry sand, or a piece of blotting paper, or the fraction of a drop of water, put upon the surface of the evaporating vessel is immediately indicated by the water column in the burette.

This is a very pretty apparatus, but entirely unsuited for exposure to sun and rain. There does not appear to be any reason why it should not give accurate details of the loss from a surface of saturated sand, in a place protected from sun and rain, but that that fact would be of material practical use we are by no means sure.

* Die Physikalischen Einwirkungen des Waldes auf Luft und Boden. Aschaffenburg. 1873,

2903. Atmometer or Evaporimeter, for determining the quantity of water evaporizing from the surface of water, as well as from different sorts of soil.

Prof. Prestel, Emden.

We think that Prof. Prestel was the first to apply the principle of the bird fountain (or Mariotte's bottle) to evaporators, and this specimen is therefore of interest. Morgenstern's, which we have just described, is merely a refined edition of Prestel's, and, therefore, we need only say that No. 2903 merely consists of a shallow dish, about a foot in diameter, with a side tube about 2 feet high.

MISSING, MISCELLANEOUS, AND SUPPLEMENTARY.

Every classification, if rigorous, leaves something which falls under the head of "appendix," "miscellaneous," "sundries," or some similar designation. No one who has spent much time in the Loan Exhibition will be surprised that we have a long list under the above head, or that even now we do not guarantee it to be perfect.

2809e. Skeleton of construction of the largest Barometers for Public Buildings, (for demonstrating purposes).

M. Richard, Paris.

2896. Barograph, balance barometer, by Greiner and Geissler, Berlin.

Deutsche Seewarte, Hamburg.

2826. Three Vacuum Thermometers for studying Solar radiation.

2875. Wind-Current Autograph, or registering apparatus.

John G. Schoen.

This "Wind-Current Autograph" marks continuously on a strip of paper the direction of the currents of wind, in such a manner that the time is indicated as the abscissa, and the angle of elongation of the weather-vane towards the north shown at every particular moment, as the ordinate.

2-95a. Registering Mercurial Thermometer, after the plan of M. Hervé Mangon.

L. Redier, Paris.

All the above are missing, or rather we should say, that we have been unable to find them.

We now pass to the miscellaneous and supplementary.

2789g. Hypsometer Apparatus, as improved by Dr. G. Henderson, with two maximum thermometers, by Hicks, in leather sling case.

Meteorological Office.

This differs in three respects from the arrangement sold by all other opticians; (1) the source of heat is a piece of candle instead of a spirit lamp; (2) the thermometer is a maximum instead of an ordinary one; (3) the brass tube in which the thermometer is boiled forms its travelling case.

2821. Sympiesometer, a sensitive instrument for sea use.

Francis Pastorelli.

In this apparatus atmospheric pressure is indicated by its capability of compressing a small quantity of air or gas confined in a chamber, owing to its greater portability than a mercurial barometer, it was extensively employed at sea, but is now generally superseded by aneroids,
(To be continued.)

LOW BAROMETER ON DECEMBER 4TH.

THE depression centre which passed across England on the morning of December 4th had many features in common with that mentioned in this Magazine, and afterwards thoroughly discussed by Mr. Marriott in the Quarterly Journal of the Meteorological Society.

We have been favoured with a very large number of returns, some of them, *e.g.*, those forwarded from Babbacombe, Torquay, by Mr. Glyde, and from Addiscombe, by Mr. Mawley, very full; in fact, the former is superior to the results of the most costly self-recording apparatus. It would, however, be inexpedient for us to devote two or three pages to the record of a single station, and we must, therefore, confine our extracts, to some of the leading features.

We hold it to be part of our duty to urge on private observers the importance of system and accuracy; we must, therefore, mention that among the mass of returns which we have received are several which are not so full as they should be. Nothing could be further from our desire than to give offence, and if we do "look a gift horse in the mouth," it is but to help the donor to give one, more creditable to all parties next time. However, if we suppress the place, the hour and the readings, it will probably puzzle even the writers to recognise their own statements, and yet the object will be perfectly obtained.

"Z a.m. My barometer stands at —— (reduced and corrected for temperature). Barometer rising at Y a.m."

This does not tell us that the first-mentioned reading was really the lowest point, it only says it was rising from Z a.m. to Y a.m.; but what it was previously doing we are not told. Therefore the minimum may have been at Z a.m., or it may have been some hours earlier. If our correspondent had said "Barometer not looked at till Z a.m., when it was ——," this uncertainty would have been removed. Again, the expression, "reduced and corrected for temperature," is not clear; by the reverse term, "corrected and reduced," we understand "corrected for index error and temperature, and reduced to sea level." But the reading reported was *not* reduced to sea level (unless the barometer is incorrect), and, therefore, probably the word reduced is altogether redundant.

"Lowest barometer registered at —— at Z a.m., corrected and reduced to mean sea level."

This is very nearly perfect; the uncertainty rests upon the absence of readings before and after Z a.m., which, by their excess above that at that hour, would have proved it to be the true minimum. We have several notes of this class.

"Barometer corrected and reduced at Z a.m. ——."

A useful statement; but its value would have been greater had the observer said whether it was then rising or falling, or at its lowest point.

HYGROMETERS.

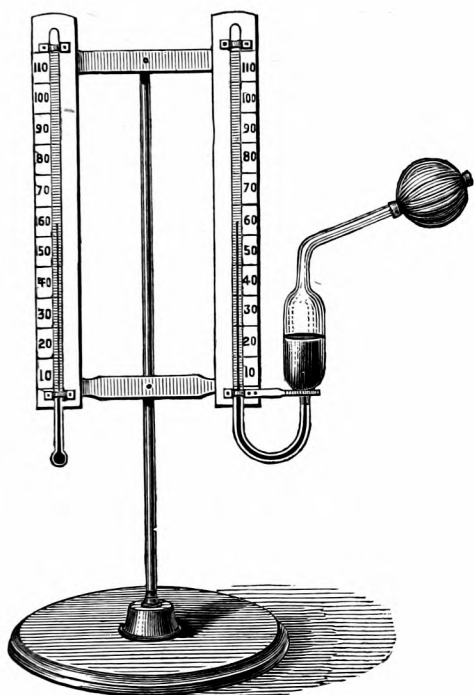


FIG. 30.

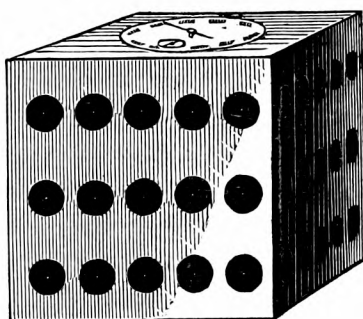


FIG. 28.

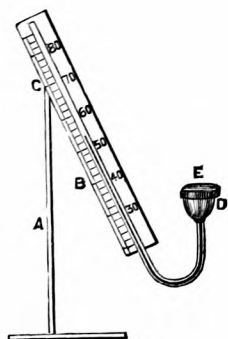


FIG. 29.

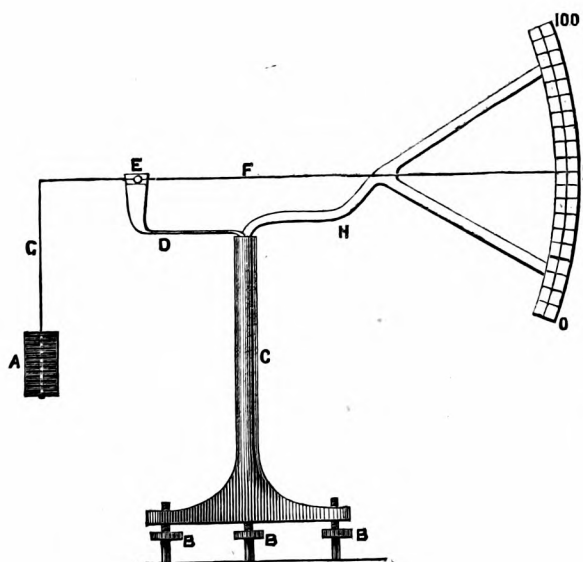
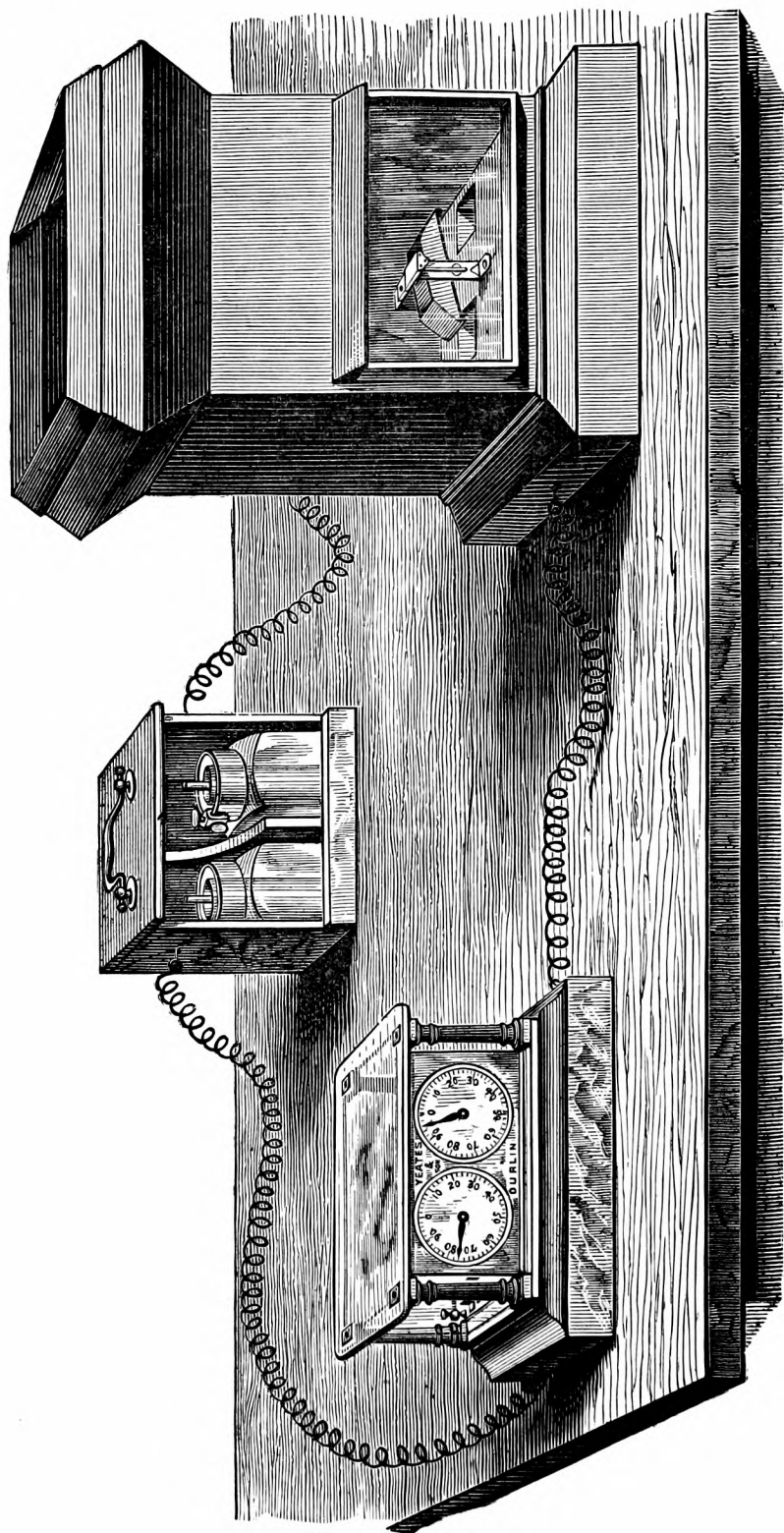


FIG. 27.



An observer sends a set of about a dozen readings, corrected for temperature but not reduced to sea level.

Tables for reducing barometric observations to their equivalent sea level pressures have been published by Lowe, Harvey Simmonds, Buchan, and in Scott's *Instructions* (a work which we strongly recommend, although the author does us the honour of ignoring our publications). We therefore hold that observers should provide themselves with some one of these works, and send the results completely reduced. Individually, the operation would not take long ; but, in the aggregate, it makes a considerable inroad upon our time.

Respecting the long series of readings furnished by several observers, we have only one suggestion to offer, viz., that observations made at hours, half-hours, and quarter-hours are more valuable than those made at irregular times, such as 5.42, 6.27, 7.11, &c. Mr. Marriott's paper (already referred to) will show at once that for tracking the progress of a depression centre we need (1) observations at each successive hour at a number of widely spread stations, and (2) the exact time and reading of the minimum at each station. It is, of course, possible to interpolate from observations such as those above-mentioned the probable pressure at 6 and 7, but it is in all respects better to have the absolute values.

Some of the long series of readings show the pumping of the barometer very clearly. We think that this feature has not received the attention which it merits. Practised observers are so accustomed to see their barometric columns oscillating or pumping to the extent of perhaps 0.01 or 0.02 in. that they perhaps rarely consider what it means, and we cannot tell them. Prof. Piazzi Smyth (if our memory is not at fault) once wrote a paper on the difference between the barometric pressure on the windward and leeward side of a house. There can be no doubt that during strong winds the pressure must be less on the latter than the former. Similarly when a rush of air passes rapidly over a house, it causes a very partial increase and then decrease of pressure therein. If pumping only occurred during extremely violent and gusty winds, the explanation above-suggested would probably meet the case. But we do not think that pumping is proportional to the force of the wind, and if not, why is it not ? and how is it produced ?

Perhaps some observer will, when he finds the barometer pumping, try the effect of placing another against a very solid post in the open air, at a distance from buildings.

Perhaps it would be well to construct a rough pattern of barometer for such comparisons, one which should render the oscillations extra large.

There is one feature in the curve of the depression as observed at Camden Square, of which we find no trace elsewhere, except slightly at Addiscombe, and of which the explanation is not obvious, viz., a distinct rise before the occurrence of the minimum.

The following sea level pressures will be sufficient :—

	Camden Sq.	Addiscombe.	Qr.-hourly change Camden.	Half-hourly change.	
				Camden.	Addiscombe.
9.0 a.m. ...	28.398	28.421	— .006		
15 „ ...	28.392		+ .009	+ .003	+ .006
30 „ ...	28.401	28.427	+ .005		
45 „ ...	28.406		— .003	+ .002	— .002
10.0 „ ...	28.403	28.425	— .012		
15 „ ...	28.391		— .010	— .022	— .018
30 „ ...	28.381	28.407	— .005		
45 „ ...	28.376		— .012	— .017	— .009
11.0 „ ...	28.364*	28.398*			

*Minimum.

The above is not due to pumping, firstly, because the mercury was not pumping between 9.30 and 10 a.m.; and, secondly, because if it had been, it would be in the highest degree improbable that three consecutive readings should have been made on the tops of oscillations; and, thirdly, that the same should have been done at Addiscombe at the same instant.

In the following table we give a selection of barometric pressures, which we believe to be accurate; and we also add a few notes.

Lowest, and lowest observed, Sea Level Pressures, December 4th, 1876.

Stations arranged as perpendiculars to a line running N.E. from the Land's End.

STATION.	OBSERVER.	Minimum Pressure.	
		inches.	Time.
Maker Vicarage, Devonport...	Rev. P. H. Newnham	28.28	4 and 5 a.m.
Babbacombe, Torquay	E. E. Glyde, Esq. ...	28.194	5 to 5.15 a.m.
Sidmouth	Dr. Radford.....	28.168	5.15 a.m.
Clifton	Dr. Burder	28.186	7.55 a.m.
Frenchay, Bristol	F. F. Tuckett, Esq. .	28.20	8.15 a.m.
Southampton	R. C. Hankinson, Esq..	28.254	8 a.m.
Ross.....	H. Southall, Esq.	28.220	8.50 a.m.
Hereford	E. J. Isbell, Esq.	28.242	8.30 a.m.
Mildenhall, Marlborough.....	Rev. C. Soames	28.27	9 a.m.
Swarraton, Alresford	Rev. W. L. W. Eyre ...	28.300	8.15 a.m.
Worthing	W. J. Harris, Esq.	28.409	7.40 to 8.10 a.m.
Strathfield Turgiss	Rev. C. H. Griffith.....	28.321	8.30 a.m.
Evesham	R. Burlingham, Esq. ...	28.216	10 a.m.
Weybridge	W. F. Harrison, Esq. ...	28.346	11 a.m.
Wrexham	Capt. Boscawen	28.359	9 a.m.
Banbury	T. Beesley, Esq.	28.175	11.15 a.m.
Kew.....	G. M. Whipple, Esq. ...	28.34	9.30 a.m.
Addiscombe	E. Mawley, Esq.	28.398	11 a.m.
Maida Vale.....	K. J. Marks, Esq.	28.383	11 a.m.
Camden Square	G. J. Symons, Esq. ...	28.364	11 a.m.
Coventry	J. Gulson, Esq.	28.26	Noon.
Hinderton, Neston	R. Bushell, Esq.	28.329	7.44 a.m.
Heath Ho. Cheadle	J. C. Phillips, Esq.	28.341	9 to 10.30 a.m.
Nottingham	E. J. Lowe, Esq., F.R.S.	28.311	11.45 a.m.
Geldeston, Beccles.....	E. T. Dowson, Esq. ...	28.36	1.40 p.m.

To the Editor of the Meteorological Magazine.

SIR,—I send you my barometric (minimum) readings for last two depressions. In the first we were near not only the centre of the cyclone, but also at the time of its greatest intensity, as judged by the comparison of minimum readings here and elsewhere.

The absolute minimum here, at 8.50 a.m. yesterday, the 4th, was 28.220 in., and at Portishead, at 8 a.m., 28.20 in., which I see was lower than yours at 11 a.m., 130 minutes later. To-day, at 2.28 p.m., the barometer again sank to 28.480 in. (sea level), or .260 in. above yesterday. You will see yesterday's reading was lower than any London reading since 1821—1843 being 28.266 in. It was lower than in 1872 and 1873, but we have no record for this district for 1843 that I know of. As to rain, we had from April 30th to Aug. 16th, 1876 (110 days), 3.22 in.; Aug. 16th to Dec. 5th, 1876 (111 days), *18.00 in.; July 10th to Oct. 28th, 1875 (111 days), 15.70 in.; July 6th to Oct. 25th, 1872 (112 days), 14.21 in.; Aug. to Nov., inclusive, 1852 (122 days), 19.80 in. So that we have had a larger fall this autumn than since 1852, if not than even then, and it is, perhaps, more remarkable that two extreme periods of opposite character should be immediately adjacent.—Yours truly,

H. SOUTHALL.

*The Graig, Ross, Herefordshire,
Dec. 5th, 1876.*

To the Editor of the Meteorological Magazine.

SIR,—The barometrical depression which has just passed over us is so remarkable, that I hasten to give you particulars thereof.

My barometer is an excellent mercurial one, which I have had in use, and have verified the accuracy of, for over 20 years. The readings were exactly followed by an exceedingly reliable small aneroid by Negretti and Zambra.

All readings are fully corrected, for temperature, capillarity, and scale error. Sea level is obtained from contour on ordnance maps, 12 inch scale.

1876.	Dec. 3rd.	9.0	a.m.	.....	28.91
	"	7.30	p.m.	....	28.88
	"	8.30	"	.....	28.74
	"	9.30	"	.....	28.62
	"	10.0	"	.....	28.56
	"	10.30	"	... ..	28.50
	"	10.45	"	... ..	28.47
	"	11.15	"	... ..	28.47
	Dec. 4th.	1.30	a.m.	.. ..	28.41
	"	4.0	"	... ..	28.28
	"	5.0	"	... ..	28.28
	"	9.0	"	.....	28.56

From 10.30–10.45, the gale blew with hurricane force. At 10.45 the wind stopped as suddenly as a clock when it has run down, and at 10.48 there was an absolutely dead calm; I suppose as a centre of the cyclone passed over us. The effect was most startling. It blew very

* To-day is not yet completed.

hard again at 3 a.m., just before the absolute minimum was reached ; and this again was followed by a period of dead calm.

I am, Sir, yours faithfully,

P. H. NEWNHAM.

Maker Vicarage, Devonport.

KEW OBSERVATORY.

WE are extremely glad to announce that the appointment of Director of Kew Observatory, held in the past by Francis Ronalds, John Welsh, and Balfour Stewart, has, at last, been conferred on the proper person. In so designating Mr. Whipple, we take an unusual position, but one which we believe to be impregnable. He has spent almost all his life in the Observatory ; since Prof. Balfour Stewart's resignation he has practically borne much of the responsibility of the management, and there is certainly no living man who better understands the establishment and the work to which it is at present devoted.

Some months since we complained of the anonymity of the Kew Committee. We do so still. We have no idea who they are, or whether they will, or will not, allow the Director to do more than carry out their orders. If they give Mr. Whipple reasonable scope, we believe that he is as certain to reflect credit on the Observatory, as were the past Directors whom we have mentioned. If they bind him tightly they will not get brilliancy, but judging by the past, they will get good and steady work.

We may as well perhaps add that Mr. Whipple is a B.Sc., F.R.A.S., and a Member of the Council of the Meteorological Society.

FINE METEOR.

To the Editor of the Meteorological Magazine.

SIR,—One of the most brilliant meteors it has ever been my good fortune to witness, appeared on Wednesday, 8th inst., at 5h. 33m. local (Berne) time ; 5h. 3m. Greenwich time.

It started from a point midway between the Pole Star and Cassiopeia, just above the constellation Camelopardus. It descended slowly through the latter constellation, perpendicularly to the horizon, disappearing after a course of about 10 degrees behind a high mountain.

Its colour was blue in the centre, fading to yellow-white at the edge—its size greater than I have ever seen Venus when at her greatest brilliancy, and it left throughout its track a tail equal in breadth to itself, but at no time longer than a degree.

The night was extremely clear, and the cold intense (15·0 Faht.) at the time.

I observe in the *Times*, of 9th and 10th, just received, that a meteor was seen at the same time in various parts of England. Can it have been the same meteor ?

Your obedient Servant,

MICHAEL FOSTER WARD, F.R.A.S., F.M.S.

Rosinière, Switzerland, 12th Nov., 1876.

NOVEMBER, 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.				
											inches	inches.	in.	
I.	Camden Town	3·07	+ ·66	·46	12	16	61·4	14*	27·6	11	5	9		
II.	Maidstone (Linton Park).....	2·33	— ·86	·36	27	23	60·0	15*	31·8	8, 11	...	...
III.	Selborne (The Wakes).....	4·59	+ 1·05	1·04	24	17	58·5	14	22·0	11	8	11		
IV.	Hitchen	3·89	+ 1·75	·66	27	21	54·0	16	24·0	10	10	...		
V.	Banbury	3·55	+ 1·35	·58	12	20	56·5	15	24·0	11	9	...		
VI.	Bury St. Edmunds (Culford).....	2·59	+ ·20	·60	12	18	58·0	16	25·0	10	6	8		
VII.	Norwich (Sprowston).....	2·76	...	·50	8	24	...	...	...	...	...	...
VIII.	Bridport	5·94	+ 2·78	1·05	26	17	60·0	14	22·0	10	8	...		
IX.	Barnstaple.....	3·53	— ·61	·56	12	19	60·0	5	31·5	7	...	...
X.	Bodmin	5·06	+ ·08	1·25	12	18	63·0	4	24·0	10	4	5		
XI.	Cirencester	4·05	+ 1·26	·73	12	17	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	3·82	+ 2·25	·67	12	16	55·0	5, 16	24·0	10	11	14		
XIII.	Tenbury (Orleton)	4·12	+ 1·65	·75	11	20	60·5	15	25·2	11	8	17		
XIV.	Leicester (Belmont Villas).....	2·99	...	·54	3	19	61·8	15	27·8	11	3	...		
XV.	Boston	2·55	+ ·41	·60	11	18	56·0	15*	29·0	10	5	...		
XVI.	Grimsby (Killingholme)	3·73	...	·90	12	22	56·0	16	28·0	11	2	...		
XVII.	Mansfield	3·91	...	·92	12	21	56·4	15	25·0	11	8	...		
XVIII.	Manchester	3·30	+ ·54	...	...	1	59·0	15	23·8	10	10	16
XIX.	York	3·11	+ 1·13	·72	12	17	58·0	15	24·0	10	7	...		
XX.	Skipton (Arnccliffe)	4·81	— 1·64	·68	18	20	53·0	14	21·0	10	12	...		
XXI.	North Shields	2·96	+ ·26	·44	7	24	54·0	15	29·0	11	5	7		
XXII.	Borrowdale (Seathwaite).....	8·00	— 8·67	1·68	21	12	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest	5·99	+ ·32	1·10	24	19	57·0	3, 15	20·4	9	4	8		
XXV.	Machynlleth	6·03	...	·91	11	20	62·0	15	20·0	8	10	...		
XXVI.	Llandudno.....	5·50	+ 2·34	·87	27	23	59·6	15	28·0	10	2	...		
XXVII.	Dumfries (Crichton Asylum).....	3·65	+ ·39	1·30	14	9	55·0	17	22·0	10	12	12		
XXVIII.	Hawick (Silverbut Hall).....	2·80	...	·88	14	14	...	...	...	...	...	...
XXIX.	Kilmarnock (Annanhill).....	2·60	...	1·31	14	17	56·1	6	23·0	10	10	14		
XXX.	Castle Toward	2·78	— 1·86	1·33	15	12	54·0	3, 5	25·0	1, 8, 9	14	...		
XXXI.	Mull (Quinish)	4·07	...	·80	19	12	...	...	...	...	...	...
XXXII.	Leven (Nookton).....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Grandtully	2·74	...	·95	14	13	...	...	...	...	...	...
XXXIV.	Braemar	2·86	+ ·04	·91	14	15	60·0	18	10·0	10	16	22		
XXXV.	Aberdeen	4·76	...	1·72	14	23	55·5	3	25·2	10	5	13		
XXXVI.	Loch Broom	1·58	...	·36	12	8	...	...	...	...	...	...
XXXVII.	Portree	3·22	— 7·26	·51	27	18	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	1·76	— ·83	·58	15	14	56·2	2	21·0	10	12	20		
XXXIX.	Helmsdale	4·23	...	1·09	14	18	...	...	...	...	...	...
XL.	Sandwick	4·70	+ ·70	·84	2	23	52·2	7	22·9	11	4	9		
XLI.	Caherciveen Darrynane Abbey.....	6·19	...	·71	10	24	...	...	...	...	...	...
XLII.	Cork	7·28	...	1·20	13	20	...	...	...	...	...	...
XLIII.	Waterford	6·00	+ 3·05	1·11	13	21	57·0	15	31·0	9, 10	2	...		
XLIV.	Killaloe	3·66	— 1·23	·59	18	18	62·0	4, 15	28·0	1, 9†	3	...		
XLV.	Portarlinton	3·11	— ·81	·52	14	25	57·0	15	25·0	9	8	...		
XLVI.	Monkstown, Dublin	5·04	+ 2·15	·73	16	17	...	...	...	...	...	...
XLVII.	Galway	4·58	...	·72	15	22	59·0	25	30·0	9	6	...		
XLVIII.	Ballyshannon	3·67	...	·63	21	23	...	...	...	...	...	...
XLIX.	Waringstown	3·43	...	·56	14	23	57·0	5	25·0	8, 9	10	16		
L.	Edenfel (Omagh)	2·53	...	·41	10	23	55·0	5	24·0	9	12	...		

* And 16.

† 27.

† Shows that the fall was above the average ; — that it was below it

METEOROLOGICAL NOTES ON NOVEMBER.

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.—The dust flying in clouds on the roads on the 1st was, perhaps, the most remarkable thing in the month; but a change speedily took place, and the second week was wintry, with frost and a little snow; the remainder of the month mostly wet, yet not remarkably so; and there were fewer fogs than usual for November. Bar. unsteady, and often low; winds during the first half N., but afterwards changing to the opposite direction.

SELBORNE.—Frequent fogs; dense ones on 6th, 14th and 23rd. White frosts on 1st, 2nd, 7th, 8th and 10th; min. temp. of November, 22°, on 11th. A very gloomy, foggy, and rainy month.

HITCHIN.—T on 27th, with .66 of rain, the max. fall of the month.

BANBURY.—Snow on 9th; hail on 11th and 26th.

CULFORD.—A very wet but comparatively mild month, the mean temp. being 42°·8; R fell on 18 days, and was slightly above the average; H and S fell slightly during the 7th and 8th. Easterly winds during twelve days; heavy fog on 10th.

OAK LODGE, SPROWSTON.—R fell nearly every day; frost and snow from 7th to 11th inclusive; the max. fall of month, .50 on 8th, is said to have been chiefly snow.

HAUGHTON HALL, SHIFNAL.—This has been a month of great changes of temperature and variety of weather; it opened with frost sufficient to cut dahlias; this was followed by a copious fall of R (.48) on the 3rd; then misty till the 7th, followed by 6 clear, frosty nights, with N. wind; this was succeeded, on 12th, by slight S and R from S.E., gauging .67, the max. fall of the month; followed by copious falls of R on most days till the 20th, then frost with fog for five days enabling many to fill their ice-houses; R fell daily, except on the 27th, till the close. Hardly any strong wind; so mild on the 5th that a humble bee was feeding on the arbutus. The greatest rainfall in any November for 35 years, except in 1852, when 6·59 fell.

ORLETON.—Fine and dry, with many severe frosts, till the 12th; soon after midnight between 11th and 12th a deep fall of snow set in, which covered the ground and continued falling all day on the 12th, changing to rain at night; the remainder of the month was cloudy, damp, and rainy, with a few fine days. There were no violent winds nor T or L during the month. The mean temp. was a trifle below the average.

LEICESTER.—A little S on morning of 12th; very mild in the middle of the month, the temp. reaching 61°·8 on 15th; less frost than usual; mean temp. of month, 42°·7.

BOSTON.—11th the max. fall of the month, .60 falling as R and S.

GRIMSBY.—With the exception of the second week, when we had hard frosts and two inches of S, the month was mild and wet; T S at 6 a.m. on 9th, the day on which the snow was two inches deep. The leaves remained on the trees longer than usual, and their colours were very fine.

MANSFIELD.—Slight S on 8th; heavy S with R on 12th, measuring .92, the max. fall of the month.

MANCHESTER.—Fog on 21st, and haze on the following day.

ARNcliffe.—28 melted snow on the 8th.

NORTH SHIELDS.—S fell on 7th, 8th, 9th and 10th.

SEATHWAITE.—S on the 9th, and on tops on 28th.

WALES.

HAVERFORDWEST.—Fine and dry till the 11th, and from the 7th to 11th frosty

(intensely so on the 8th and 9th), after which the fine weather, which had continued from the 20th of last month, broke up, and from that time to the end of the month it was mild, wet and stormy.

MACHYNLLETH.—S on the 11th and 12th, a great part of the fall on those two days, which together amounted to 1·45, being melted S; the month was very wet and mild for the time of the year, many days being more like summer than November; S on the mountains on the 28th.

LLANDUDNO.—Wet month; rainfall greatly above the average; but there were some very fine days, temp. very slightly below the average; only two nights' frost; S and sleet at 3.30 p.m. on 8th; H showers in the night of 9th; S on the hills on 10th and till the 14th, and again on 29th.

SCOTLAND.

DUMFRIES.—The usual November frost nip commenced this year on the 7th, and lasted a week; there was scarcely any frost again until the end of the month, hence the mean temp., 40°·8, is one degree higher than last year. A very heavy rainfall (1·30, the max. of month), with an easterly wind, was recorded on the 14th; the R generally has fallen when the wind was in that direction.

HAWICK.—On the morning of the 8th the ground was covered about six inches deep with S, which had fallen during the night, and as there had not been a breath of wind, the trees looked fantastic and singularly beautiful. The month has been remarkably mild.

ANNANHILL.—Mean temp. 41°·5; rainfall light, the max. of month, 1·31, fell on the 14th, with an easterly wind. Winds principally E. or S.E., usually light, the only exception being on the 12th, when a gale blew up from the E.

CASTLE TOWARD.—The rainfall (2·77) considerably below the average, and that of 1875; the weather throughout the month has been pretty favourable for out-door labour, as we had some frost, which kept the ground in good working order. There has been but little snow here during this month, only one slight sprinkling on the 12th; there has been but little wind.

BRAEMAR.—A month of changeable weather; the lowest temp. was 10°, being the min. of the year 1875, and on the same day, viz. 10th.

ABERDEEN.—Bar. pressure, mean temp. (42·1) and rainfall all above the average; winds from N., S.E. and S., more frequent than usual, the estimated pressure rather below the average. A month of dull, wet and dreary weather, with rather a high temp., notwithstanding the sharp snowstorms on the 7th to 11th.

LOCHBROOM.—A remarkably fine, dry month; outside work has been successfully prosecuted during the whole month; the finest November for years; 12th wet and stormy.

PORTREE.—A fine open month, 5·80 inches below the average of the last 16 years for November. Ground slightly covered with S on the 11th; solar halo on 8th; lunar halo on 29th and 30th; southerly gales on 15th, 22nd and 23rd; frosts daily 7th to 12th inclusive. Cattle and sheep healthy, and thriving well on the pastures.

CULLODEN.—S daily 7th to 11th inclusive; faint aurora on night of 19th; S on the morning of the 30th.

SANDWICK.—November has been wet and cold; the ground was covered with S from the 8th to the 11th inclusive, which was much earlier than usual; auroræ were noticed on 10th and 19th.

IRELAND.

DARRYNANE.—A mild but wet month; rain generally at night, the days often dry and spring-like.

KILLALOE.—Month very mild and fine, unusually so for the season.

MONKSTOWN.—Month unusually wet, and also remarkable for the absence of frosts, which only occurred on three nights; heavy H on night of 8th, the ground being quite white next morning.

BALLYSHANNON.—The month, though wet, has been mild, and consequently cattle have been left out longer than usual, and thus a great saving in fodder has resulted. A sharp frost came on the 8th, and though lasting only till the 10th, any bedding plants remaining in the open ground were killed; rainfall more than corresponding period of last year, '01 of inch.

WARINGSTOWN.—Mild (except 7th, 8th and 9th), and rather wet, giving sufficient intervals for sowing the wheat crop, which was got in fairly well.

OMAGH.—Weather of the first week a continuance of the fine period which commenced on 19th of October; remainder of month dull and rainy, but mild, with little frost and no snow.

SUPPLEMENTARY TABLE OF RAINFALL IN NOV., 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	3·55	Llanfrechfa	6·52
Hailsham	3·37	Castle Malgwyn	4·93
Andover.....	3·25	Heyope	4·40
Strathfield Turgiss	4·06	Rhug, Corwen	4·37
Addington Manor.....	3·60	Port Madoc	5·32
Oxford	3·07	Melrose	3·62
Cambridge.....	2·57	Cessnock, Glasgow	3·64
Sheering	3·25	Gruinart	2·89
Ipswich	3·50	Keith	3·62
Diss	2·59	Stratheonan .....	...
Swaffham	2·84	Springfield, Tain	3·45
Compton Bassett	3·78	Skibbereen .....	...
Dartmoor	8·94	Glenville, Fermoy	7·76
Teignmouth	5·77	Tralee.....	4·07
Torrington (Langtree) ..	4·34	Newcastle W., Limerick ..	3·57
Trevarrick, St. Austell..	6·15	Kilrush	2·41
Taunton.....	4·54	Kilkenny	3·79
Bristol	4·48	Kilsallaghan	5·05
Sansaw	4·22	Twyford, Athlone	4·29
Cheadle	4·02	Ballinasloe.....	3·07
Ashby-de-la-Zouch .....	...	Kylemore	10·84
Coston, Melton Mowbray ..	3·02	Bangor .....	...
Bucknall	3·25	Carrick on Shannon.....	3·61
Walton, Liverpool	4·46	Rockcorry	2·81
Broughton-in-Furness ..	3·67	Warrenpoint	6·38
Stanley, Wakefield	3·10	Bushmills	3·05
Gainford	3·11	Buncrana	3·13
Shap	4·01		

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXXII.]

JANUARY, 1877.

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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 $X \overset{1877}{-} X$ 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 .....	.17	.09	.84	...	.20	.47	.12	.05	.04	.40	...	.02	.02	.30	2.56
Culford	P. Grieve .....	.11	.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	...	.06	.17	1.65
Bridport	G. M. Evans .....	.02	1.22	.31	.15	.24	.61	.24	.40	...	.36	...	.09	.30	.20	4.14
Barnstaple	W. Knill .....	.08	.60	.10	.16	.35	.49	.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	...	...	.01	.27	2.67
Shifnal	J. Brooke .....	.08	.06	.92	...	.13	.31	...	...	.11	...	...	.09	.11	.27	2.08
Orleton	T. H. Davis .....	.09	.20	.77	.06	.10	.33	.07	.01	.04	.05	...	.02	.07	.40	2.21
Leicester	H. Billson .....	.17	...	.79	.03	.14	.27	.01	.13	...	...	...	.01	.04	.26	1.82
Boston	W. H. Wheeler .....	.10	...	1.28	.02	.09	.17	...	...	...	...	...	...	.05	.27	2.11
Grimsby	J. Byron .....	.05	...	.90	.07	.05	.11	.05	.01	...	...	.05	...	.05	.16	1.50
Mansfield	R. Tyrer .....	.21	.02	1.51	.03	.08	.30	.07	.01	.01	.01	...	.01	.04	.31	2.60
Arncliffe	W. Boyd .....	.27	...	.81	.64	.42	.50	.39	.02	.05	.01	...	.11	.09	.65	3.96
North Shields	R. Spence .....	.38	...	.71	.18	.30	.16	...	.01	.06	...	...	...	.02	.09	1.91
Cardiff	W. Adams .....	.08	.63	.72	.01	.23	.21	.04	.05	.04	.53	...	.05	.25	.19	3.03
Haverfordwest	E. P. Phillips .....	.36	.73	.07	.10	1.31	.40	.10	...	.17	.32	.10	.04	.90	.36	4.96
Machynlleth	J. Johnstone .....	.22	.09	1.24	.36	.72	.56	.05	...	.32	...	...	.10	.34	.36	4.36
Llandudno	J. Nicol .....	.06	...	.60	.17	.25	.48	.03	.09	.04	...	...	...	.05	.30	2.07
Aberdeen	A. Beverley .....	.05	...	.23	.12	.07	.33	.05	...	.03	...	.02	.04	.07	.19	1.20
Waterford	E. Garnett .....	...	.57	.66	.08	.14	.55	.03	.08	...	...	.28	.06	.43	.07	2.95
Monkstown	G. Pin .....	.59	.13	1.40	.02	...	.75	...	.07	...	.02	.03	...	.10	.09	3.13
Warrington	T. Waring .....	.04	.01	.90	.22	...	.35	.32	.07	.10	.04	.23	.04	.24	.17	2.73

ADDITIONAL STATIONS IN SOUTH-EAST ENGLAND.

Beckenham	P. Bicknell .....	.25	.28	.50	...	.08	.47	.31	.62	...	.98	.26	...	.03	.29	4.01
Crowboro' 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.

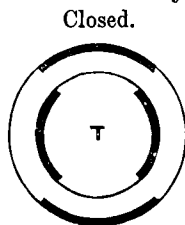


Fig. 1.

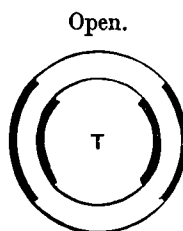


Fig. 2.

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. Dietheroscope. *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. **Schönbein'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

• Met. Mag., vol. ix., p. 146.

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 une 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.

* 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. in.	Station.	Total Rain. 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	On grass	
		inches.	inches.	in.									
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	...	
"	Barnstable.....	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 (Haughton 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 R 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.