

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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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	13	...	$90^{\circ}0$	|	1874	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.		In shade	On grass				
				Dpth	Date.						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.