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CATOR'S IMPROVED ANEMOMETER.

A description of Mr. Cator's anemometer, as fitted up with the double-curved levers, was given in a previous number (XXIII. Dec. 1867); we have pleasure in now supplementing it by the following note.—ED.

"Another plan for measuring the strength of the wind having about that time suggested itself to me, I applied it to the instrument, and had it fitted up,—not intended as an improvement upon the levers, which may or may not be the case, and remains to be seen, but as it seemed to be worth a trial, it being so easy to apply it to the instrument by disconnecting the levers and connecting it instead, or *vice versâ*, and this ready application of either principle must be considered a great advantage. This new application is a system of double spirals, of which the following is a description:—

The other parts of the instrument being explained at length in the number above referred to, this notice is limited to the spirals. Figure 1 is the same figure reproduced here with the addition of the spiral apparatus (*h*), and the support (*r*) to which it is fixed. Figure 2 shews the spiral apparatus in detail. The spirals or snails are concentric and rigidly connected together with each other and with a horizontal rod passing through their centres, and revolve, with such rod as their common axis, in vertical planes side by side, the horizontal rod resting on strong supports (*r*) at each end of it. The two spirals are of different sizes; the perimeter (*d*) of the smaller one is equal to the length of the scale of pounds on the recording-sheet (*n*), and also to the total space through which the pressure-plate (*a*) is moved, viz. about 5 inches; and round this is wound a chain (*d*), one end of which is rigidly fastened to the rod at its centre, and the other to the steel wire (*d*) which comes down from the bar connected with the pressure-plate; and it is so adjusted that when it is calm (fig. 2 shewing their position in a state of calm), the chain is wound wholly round this spiral, and leaves it as a tangent at the point furthest from its centre. viz. about 2 inches: and as the pressure-plate is moved forward by the wind, the steel wire (*d*) is lifted up, and so unwinds the chain (*d*) from the spiral, and causes it to leave the spiral as a tangent, accordingly, at

a point nearer to its centre. The other spiral (*p*) is of much larger size; and round its perimeter is wound a string (*p*) to one end of which is fastened the horizontal rod which passes through its centre, and to the other a weight (*o*), which is adapted to the size of this spiral: it is so arranged that, when it is calm, no part of the string is wrapped round this spiral, but it merely hangs direct from, or is a tangent to the curve at its centre; and as the pressure-plate is moved forward by the wind, this spiral (being rigidly connected with the other one) is made to revolve, and the string (*p*) to be wrapped round it, leaving it as a tangent, accordingly, at a distance from its centre.

From the above it will be readily seen that the two spirals are moved through equal angles, and act reversely (or with opposite intensity), the small one being unwound while the large one is being wound, the tangential chain (*d*) of the small one nearing the centre as the tangential string (*p*) of the large one becomes at the same time further from it; and so the effect is doubled. The apparatus may be considered as a continual series of levers, the actual and relative lengths of the two arms from the fulcrum being gradually altered as it is made to revolve: in the first instance, a very small force applied at the pressure-plate, or, which is the same thing, at the end of the chain, will cause the apparatus to revolve, and will lift the fixed weight (*o*) hanging from the centre or fulcrum; and power will always be gained, or, in other words, the pressure of wind will always be less than the fixed weight, till it has revolved through such an angle that the chain (*d*) and string (*p*) are at the same length of arm from the centre; and as it revolves further round, the pressure of the wind, so causing the chain to act at a shorter and shorter arm or nearer and nearer to the centre, will be always proportionately greater than the fixed weight, which will act at a longer and longer arm, or further and further from the centre. The string which carries the recording-pencil (*f*) to and fro is fastened to the steel wire (*d*) at a short distance above the chain belonging to the small spiral.

Beckenham. C. O. F. CATOR, M.A.

ELECTRICAL ANEMOMETERS.

To the Editor of the Meteorological Magazine.

SIR—I notice, through the pages of your interesting magazine, that the attention of meteorologists is being drawn to electrical anemometers, it having been stated that arrangements are to be made for the indications of the anemometer lately erected at the Botanical Gardens by means of electricity.

As I have for some years past taken great interest in this particular branch of meteorological science, and have devised and used electrical anemometers of several descriptions in situations where it would have been impracticable to have placed the ordinary arrangement, I venture through the medium of your publication to describe, for the perusal of your readers, my latest contrivance, which is, I think, the simplest yet arranged; as it obviates the use of a battery, I think it all the more

likely to meet with the approval of meteorologists who may not have had much experience in electrical batteries.

On the spindle which supports the cups, and near the foot of it, is placed a worm, which is geared into a large toothed wheel, with a definite number of teeth cut in it, according to the scale upon which the instrument showing the velocity is graduated, that is to say, if it is desired to show the velocity at more frequent intervals, this wheel must have fewer teeth in it, in order that it may revolve faster.

The axle on which this wheel is fixed carries a "camb," such as is used in the "cutting off" arrangement in the Kew barograph and thermograph instruments.

Working on this camb is a long bell-cranked lever, to which is attached at the end remote from the camb an electro-magnet, the poles of which are in proximity to those of a powerful permanent magnet.

As soon as the end of the lever falls into the camb, the coils of the electro magnet are suddenly withdrawn from the permanent magnet, the result being that a current of electricity is induced, which is connected by the wire leading from the anemometer to the recording apparatus, which may be placed at any distance from the cups.

The counter or indicator may be an ordinary "Compteur Electrique" on Brequet's principle, or it may be made to register on paper the varying velocity of the wind by an apparatus specially devised, three of which I have made.

I have been induced to use magneto-electricity in these apparatus for two reasons—first, to avoid the trouble of a battery, and in the second place, in the peculiar arrangement just described, the necessity of a contact maker for transmitting voltaic currents is dispensed with, which in practice is found to be a very difficult thing to arrange, to suit light winds and strong gales equally well.—I am, yours truly,

LOUIS J. CROSSLEY.

Willow Hall Observatory.

SOLAR RADIATION.

To the Editor of the Meteorological Magazine.

SIR,—Although I feel considerable diffidence in writing on a subject which is, to a great extent, new to me, I will venture a few remarks on solar radiation thermometers, leaving it to you to judge if they are worthy of insertion.

It is obvious that the temperature of a thermometer exposed to the sun depends on two things.

1st, the rate of heating by the sun's rays;

2nd, the rate of cooling, by radiation into space, and by the convection of the air.

That the temperature may be stationary, these two effects must be equal. If the first be in excess, the temperature will rise, if the second, it will fall, and as the rate of cooling depends on temperature, it will, in either case, soon reach a position of equilibrium.

By surrounding the bulb with an exhausted envelope of glass, we

largely prevent the cooling action of the air, but we also interfere with the radiation into space.

If the thermometer radiated the same kind of heat which it absorbed, the character of its coating would be of no consequence, for it would affect both radiation and absorption in the same proportion. But while much of the heat which it absorbs is luminous heat, the whole of its radiation is obscure. While the glass is very transparent to the luminous rays of the sun, it is almost opaque to the obscure radiation of the thermometer. The result is a veritable heat trap; the heat gets in and can't get out, and with suitable envelopes almost any temperature might be obtained.

Thus the indications of the thermometer must be affected by the thickness and quality of the glass envelope, and if a cloud came over the sky, without obscuring the sun, the thermometer would rise, from lessened radiation into space.

In fact it seems to me that the determination of solar radiation from the indications of *any* thermometer is a problem involving two unknown quantities, both subject to perpetual variation; and I should fear that mere thermometric observations can never give results of real value.

The only absolute method of measuring solar radiation with which I am acquainted, is by adopting the principle of Pouillet's Pyrheliometer, in which the increase of temperature of a mass of water or mercury, in a given exposure to the sun's rays is noted, and compared with its loss by radiation when shielded from them.—Yours truly,

HENRY R. PROCTER.

North Shields, Sept. 26th, 1870.

To the Editor of the Meteorological Magazine.

SIR,—Can you find space for the following extract?—"Sir H. Davy ignited the charcoal points connected with a battery in a vacuum, taking care to place the charcoal points at the top of the jar, and a concave mirror with a delicate thermometer in its focus, at the bottom of the vessel placed upon the air-pump plate. The effect of radiation was ascertained, first when the receiver was full of air, and next when it was exhausted to $\frac{1}{120}$th. In the latter case, the effect of radiation was found to be three times as great as in an atmosphere of the common density."

It would be easy to try a similar experiment with sun instead of charcoal points, and without the mirror, but the above is enough to render it at least probable that the low readings mentioned by Mr. Nunes', result as you suggested, from imperfect exhaustion.

I remain, Sir, your obedient servant,

F. W. STOW.

Hawsker, October 30th.

To the Editor of the Meteorological Magazine.

SIR,—I have just seen Mr. Nunes' letter. His experiments confirm the conclusion which I thought might be drawn from an experiment made by the late Sir H. Davy, of which I sent you an account too late for

publication in your November number. The results he has obtained are very satisfactory to me, because they prove that Casella's thermometers in vacuo are as carefully and correctly constructed as I believed them to be. The same no doubt is true of Negretti and others. Permit me to analyse the figures given. I will take those days only on which, from the number of observations taken, we may presume there was some steady sunshine.

Oct.	Casella. B	Pastorelli's new vacuum. F	Diff. B—F	Pastorelli's original vacuum. A	Pastorelli's new vacuum. F	Diff. A—F	Pastorelli's original vacuum. A	Pastorelli's new non-vacuum. H	Diff. due to exhaustion in A A—H
14...	111·7	112·5	—0·8	98·5	112·5	—14·0	98·5	99·7	—1·2
15...	111·0	108·3	+2·7	97·2	108·3	—11·1	97·5	97·1	+0·1
17...	107·7	104·6	+3·1	94·2	104·6	—10·4	94·2	94·0	+0·2
18...	114·5	110·8	+3·7	99·5	110·8	—11·3	99·5	99·5	+0·0
Means.	111·2	109·0	+2·2	97·35	109·05	—11·7	97·35	97·57	—0·2

Thus we find that (1) there is a pretty close agreement between Casella's thermometer and the new and carefully constructed one of Pastorelli's. The difference, however, is in favour of Casella, showing that Casella's has either a slightly better vacuum, or (as I think) reads higher from the other causes which I mentioned—viz., smaller size of bulb and larger size of jacket. (2) The difference between Pastorelli's original instrument and his new one (both professing to be in vacuo) is enormous. (3) There is a suspiciously close agreement between Pastorelli's original thermometer *in vacuo*, and his new one *not in vacuo*. The only conclusion that I can draw is, that by some unfortunate accident, the air gained admission into the former in course of manufacture, there being no other difference in the construction of A and F, which could account for a tithe of the difference in their readings. I think all observers owe thanks to Mr. Nunes for having thus laid the ghost which he had conjured up.

It is possible that thermometers in unexhausted jackets may give good results, but they can hardly agree with one another more closely than the present vacuum thermometers do when properly constructed. As they read lower, they give a smaller "amount of radiation," and cannot therefore give so delicate a test of the sun's power. I think all your readers will agree with me, that unless they should be proved to be very superior to those used at present, it would be a great mistake to introduce any new mode of registering the sun's heat. The present instruments are very good. Mr. Casella informs me that he guarantees all those which he makes to be within $\frac{3}{4}$ per cent of an absolute vacuum.

From the returns which Mr. Nunes is so kind as to send me, I find that the difference between sun and shade, or 'amount of solar radiation,' was reduced in H compared with F by 23, 21, 21, and 21 *per cent* on the 14th, 15th, 17th, and 18th October respectively.

Mr. Nunes is a little hard on me in reference to some minor points.

I did not say that large bulbs read lower *in all cases* than small ones. On the contrary, when the stem is not blackened, or insufficiently blackened, the large bulbs always read higher, because their greater bulk is less affected by the colder stem. What I meant to say is this, that *ceteris paribus* the large bulb reads somewhat lower: and in this I do not "labour under a delusion," unless Mr. Nunes can disprove the law that the surface of a sphere varies as the square of the diameter, but the mass or bulk as the cube.

I certainly do lay stress also on the superior sensitiveness of small bulbs. It may not "make much difference *in the long run*," but on days when there are only gleams of sun, it makes a good deal of difference. How else is the great excess of B over F on the 25th, to be accounted for?"

Mr. Nunes does not understand what I mean by the sensitiveness of thermometers in vacuo, "when used as ordinary thermometers." I mean that if both stand say at 50°, and are put in a dark room where the temperature is 60°, the ordinary thermometer will reach 60° first; and if the experiment be reversed, the ordinary thermometer will fall to 50° first. Of course the experiment should be tried with thermometers having equal-sized bulbs. But I dare say vacuum thermometers are sensitive enough, and do not attach much importance to this point.

I laid no *stress* whatever on testing thermometer stands by a black bulb *not* in vacuo; all I said was, "It would not be *necessary* to use thermometers in vacuo for this purpose."

The shade thermometer which we compare with the sun thermometer ought if possible to be unaffected by reflected heat: and as on Mr. Nunes' stand the ordinary thermometer was on one occasion affected by this cause 11° *less* than the thermometer in vacuo, I would use the former as being *nearer* to the true shade temperature, though I certainly prefer his second alternative, that we ought to "alter our thermometer stands so that they are unaffected by radiated light," or more correctly, radiated or reflected *heat*. Whatever the result of the millions of figures magnificently elaborated at Strathfield Turgiss, we shall hardly be asked to adopt any stand which does not satisfy this condition.—I am, Sir, your obedient servant,

Hawsker, Nov. 20. FENWICK W. STOW.

THE SQUALL OF OCTOBER 19TH.

To the Editor of the Meteorological Magazine.

SIR,—The only fact of importance omitted in my letter to the *Times* was, that we heard two short sharp growls of thunder immediately before the squall.

The apparent hushing of noise at the time was occasioned probably by the branches being blown stiff by the force of the wind; they appeared to be fully extended and rigid.

I understated the number of trees blown down; probably there were fifteen oak, and two ash, the latter broken off in the middle. A farmer near had the thatch blown off his ricks.

It had been blowing a gale of wind all the morning, accompanied by driving rain, and the weather previously had been unsettled. On the Monday previous the ground was slightly covered with snow.

I am quite sure as to the time of day being 10.45, when the squall passed us. Yours obediently,

JOHN LLOYD, JUNR.

Huntington Court, Hereford, November 30th, 1870.

To the Editor of the Meteorological Magazine.

SIR,—Negative evidence may be as good as positive in tracing the course of this squall. On the 19th I registered heavy rain, hail, and high gusty wind. 20th, ditto, without the hail. The force on both days 8 (1 to 12 estimated). Barometer 29·49 and 29·56 respectively, corrected and reduced. The 23rd, barometer the lowest reading of the month, 28·93, and I concluded there were heavy gales somewhere; but my estimate again did not exceed 8 as the maximum force. There was nothing remarkable about the wind here on either of those occasions. Gales of greater violence raged in this locality on the 12th and 13th. The direction of the wind on 19th and 20th was W.N.W. From your table it would appear that the storm was probably cyclonic. showing great force to the N. in Breconshire, and to the S. in Somersetshire. This neighbourhood, therefore, was near the centre, and consequently in comparative calm. Your table does not give the direction of the wind at the different stations. Faithfully yours,

FRANKLEN G. EVANS, M.R.C.S., F.M.S, &c.

Tynant Radyr, Pentyrch, near Cardiff, November 25th, 1870.

P.S. Be kind enough to publish Mr. Geo. D. Brumham's meteorological law, for general information.

To the Editor of the Meteorological Magazine.

EXTRACT FROM METEOROLOGICAL REGISTER, OCT. 19TH, 1870.

Barometer.

9 a.m. ... 29·514 f. 9 p.m. .. 29·390 s.

Thermometers. *Means of day.*

min.	max.	solar.	dry bulb.	wet bulb.	dew point.	deg. of hum.
49°·5	60°	94°	52°	50°·5	49°	89°

	Elastic force of vapour.	Mean in cubic foot of air.	Short of complete saturation.	Mean weight of cubic ft. of air.
9 a.m.	0·374 in.	4·2 gr.	0·4 gr.	532·3 gr.

The tornado was not noticed here.

Rainfall in 24 hours, 0·650 in.; ozone (0-10), 8; Wind (Robinson's Anemometer), 915 miles in day; cloud (0-10), 8.

Gale with heavy rain and lightning from S.W.

On October 23rd, 1·355 in. of rain with hail fell in 24 hours.

C. S. BARTER.

27, *Paragon, Bath.*

To the Editor of the Meteorological Magazine.

SIR,—The peculiar character of the squall of October 19th, was clearly marked here. At 10 a.m. the wind was S. dry bulb. 56°·2:

rain just commencing, with a rising gale. At 11.30, strong southerly rain squalls sweeping by. At 11.42, as near as I can correct the time, the wind instantaneously changed to N.N.W., with a tremendous "splash" of rain; and the dead leaves which strewed the lawn in front of my windows whirled round and round, in a circle of about 40 to 50 yards diameter, the gyratory motion carrying them gradually upwards. This "whirlwind" continued at least one minute, and the great downpour of rain did not last much longer.

As I am writing, I may mention that in the splendid aurora of October 25th, as seen from this place, two streamers distinctly shot up to the zenith from the centre of a southern arch, at 7.10 p.m. These were not prolongations of northern streamers, for there were none such at that particular time. I beg to call attention to the fact that this aurora of October 24-26 is strictly periodical.

At Bridport and at this place, about 10.40 p.m., on the 22nd instant, a loud earthquake rumbling was plainly heard. I was at Bournemouth on that night, and did not notice this phenomenon; but at 0.45 on the morning of the 23rd, in the midst of the sharpest thunder and lightning squall that I ever saw in the winter, two distinct earthquake waves passed by, from nearly W. to E. The movement was more upwards and downwards than oscillatory; my bed appearing to be bodily elevated and then let down again. Faithfully yours.

P. H. NEWNHAM.

Frome Vanchurch, Maiden Newton, Dorchester, November 26th, 1870.

To the Editor of the Meteorological Magazine.

SIR,—In your monthly number of the *Meteorological Magazine* for November, you ask for further particulars of the squall or tornado, that swept over the west and south of England on the 19th ult. In addition to the few facts noted in my letter which you have inserted from the *Times*, I would add, that the path of the severe gust was traceable here for at least a mile, and was about fifty yards wide; the wind coming from W.S.W. Several chimneys and small trees, six to nine inches in diameter of stem, were broken and thrown down, and many branches of large trees wrenched off, one house was unroofed, and another partly so, and windows of other houses were blown in. The anemometer which was in its path recorded the great pressure of 30 lbs. on the square foot. Very curiously, trees which had a large branch broken off, were in almost all cases otherwise uninjured; the damage being done only in spots, very weak limbs and twigs only three or four feet away from those wrenched into splinters, suffering no injury whatever.

Not being able to reconcile the facts given from different places in the south of England with one another, I had laid down the wind currents as given, of the preceding and following days; and as therefrom I think the cause of such destruction is clearly to be traced, I offer you the sketches I made at the time, and the conclusion I came to.

On the morning of the 18th, the wind in this part of Europe, was an equatorial one; and blowing in the southern part of the British

Isles from south, and with the force of a gale on the south coast of Ireland. Early in the morning of the 19th, this current became influenced by a polar wind, coming across the North Atlantic from the N.W.; which gradually diverted and turned the equatorial current from south; and on the forenoon of the 19th, although the equatorial current retained the force of a storm, it was so far forced aside by the stronger or larger polar current; and by the morning of the 20th, the polar current, still with the force of a storm, was, although changed in direction, supreme over Britain and its environs.

Now the tract across the west and south of England, marked with such extraordinary devastation, was where these two winds struggled with their full force upon one another for the mastery. Impinging and breaking in upon one another, the tract of their fierce collision entered the south-west of England, about ten a.m., passing over the south, and leaving the south-east coast at about three p.m.

Their battle track was doubtless also well marked, as it advanced across the Irish Sea and Ireland, and possibly the loss of the steam ship *Cambria* can be traced to it.

Their furious combat did not probably proceed further than the east coast of England, as the equatorial current, although itself deflected in doing so, had curled the polar current northwards over the German Ocean on the morning of the 20th. This storm is the more interesting, as it resulted from the collision of two winds in our land, instead of, as is usual with us in our great storms, from a cyclone passing over us, which had been generated in the tropics.

I enclose you six rough tracings, shewing the winds' course, the equatorial wind being coloured red, and the polar blue.

The Weather Book by the late Admiral Fitzroy p. 235, and diagram VII., I see describes such a storm.

The tidal wave noticed at Salcombe was doubtless caused by the polar current driving southward, the water of St. George's Channel, while the equatorial current as abnormally raised that from the Atlantic.—Yours faithfully,

J. R. MANN.

East Cowes, Isle of Wight, 24th Nov. 1870.

To the Editor of the Meteorological Magazine.

SIR,—The storm of October 19th reached us at 0.30. The wind in the town did not attract much attention, but the violent rain with hail which followed, was especially noted. There was no thunder nor lightning here. The rain measured next morning was 0·37 inch. I think most of it fell during the storm. No mischief was done in the town, so far as I know; but at Milcomb, 4 miles S.W. of Banbury, trees were blown down. At Wardington, 4 or 5 miles N.N.E. of Banbury, many trees were blown down or broken, and the ridge of a house was taken off. My informant particularly mentions the way in which the trees were twisted. The wind came in two "puffs" from the S.W.; and the course seemed, from the damage done, to be a quarter of a mile wide. In Edgcote Park, just beyond Wardington, many trees blown down or

damaged. At Radway, just below Edgehill, 7 miles N.W. of Banbury, the vicar, the Rev. G. Miller, says: "I did not see the havoc among the trees till some few days after. The width of the damage done was about 300 yards, and the length about one mile. Beyond this distance there are no particular traces of the storm" At Burton Danete, two or three miles N.E. of Radway, the roof of a barn was taken off, and a wall blown down. The wall fell towards the apparent course of the wind.

It is probable that further inquiry would discover many more traces of the storm. If the gale had been more noticeable at Banbury I should have been led to make more investigation at the time.

I cannot hear of any change in the direction of the wind during the storm. Truly yours, T. BEESLEY.

Laboratory of Analytical Chemistry, 5, High Street, Banbury, November 27th, 1870.

To the Editor of the Metcorological Magazine.

SIR,—Having read the reports of your various correspondents respecting the storm of the 19th of October, I beg to offer a few remarks on the subject. A similar if not more severe storm occurred at this place on the same day. During the morning nothing in particular happened to indicate its approach, the wind was S.W., with a little rain; about 12·40 a most terrific gale sprang up, due west, it swept everything before it, one elm in particular, of very large size, containing more than 300 feet of timber, without reckoning the limbs and the top, was blown up; others were broken in two at different distances from the ground; one of these was two feet in diameter. In fact, the wind destroyed everything with which it came in contact; perhaps the most remarkable circumstance connected with the hurricane is, that it should have spent all its force in a valley, whilst the surrounding hills were not in the least affected; it lasted not more than two or three minutes, and during that time the rain came down in sheets of water, accompanied by occasional pieces of ice, the whole atmosphere being darkened by the branches and leaves of trees, &c., moving with the wind. The length of the district affected must have been about 1,000 yards; and the width about 300, just through the middle of the valley, and direct from west to east; it would be very easy to draw a line on each side of the course taken by the wind from the effect it produced. J. DANIELS.

Swyncombe Gardens, Henley-on-Thames.

To the Editor of the Metcorological Magazine.

SIR,—The gale which had been raging all the previous evening continued throughout the night and early morning, but moderated towards 8 a.m.; in the course of the forenoon it however recommenced. About 1 p.m., or shortly after, a very heavy and severe squall suddenly sprang up from W. and S.W.; the afternoon and evening were very stormy, and the wind was high and gusty.

W. J. HARRIS, F.M.S.

Worthing.

To the Editor of the Meteorological Magazine.

SIR,—Seeing by your Magazine that you wish for more information respecting the squall of October 19th, I send you an account of what was witnessed of it here.

The day in question was very windy, with a little rain. Barometer falling 29·576 at 9 a.m., 29·316 at 9 p.m., (corrected to sea level and 32°.) I saw the storm coming up from the S.W., a few minutes before two p.m. The height of it here was two or three minutes after two. I cannot tell exactly the minute, but I am sure it was past two, but not five minutes past. The first damage it did was, after crossing the river Granta, partly moving a very fine plane tree close to the river, then taking a north-easterly course for about fifty yards, it blew completely up by the root three very large elm trees, twisting off numerous branches in its course, and tops off other elm trees across the park for about a quarter of a mile, damaging the trees by twisting off the branches not like an ordinary wind, showing that it was a whirlwind. I saw the leaves and small branches from near where the elms were blown down, taken high up in the air, and many of them fell some fifty or sixty yards N.W.

What seems to me most curious is, that it was only in the valley that any damage was done to the trees, for it passed trees on an elevated spot, just before getting to the river, and the last marks it left were near the top of a hill on the other side of the park, its course being nearly E.N.E. The rainfall during the storm, which I should think lasted from one to two minutes, was 0·12—temperature about 67°.—I remain, Sir, your obedient servant,

J. BRYAN.

Audley End Gardens, Saffron Walden, Nov. 23rd, 1870.

ERIDGE, TUNBRIDGE WELLS.—Rain began at 11 a.m.; at 1.55 p.m. a sudden squall with rain and hail. The wind was violent, and the darkness considerable. The wind at the time shifted from S.S.W. to W.N.W.

To the Editor of the Meteorological Magazine.

SIR,—I have read with great interest the accounts of the severe squalls which visited several parts of the west of England, on the 19th of October, 1870. These accounts are sadly deficient in giving the direction of the wind, otherwise we should be able to ascertain with some degree of precision whether these squalls conformed at all to the ordinary type of revolving gales. You give the rate of lateral progress at about 50 miles an hour. It, however, appears unlikely that they all were one and the same squall, which visited the stations in succession. If it were the same squall that visited Kingsbridge and Chepstow it would partake of the nature of a zone of very violent force, in a larger revolving storm, the centre of which was to the west of the two stations. At Llanwrtydd, upon this hypothesis, the centre was to the north. Extracts from registers kept in different parts of the west of England, other than those visited by the squalls, would supply a great

deficiency and go far to elucidate a question, suggested by a Committee of the Royal Society in 1840, which I believe has not received the attention it demands, viz.—the nature of the wind-flaws between ascending columns and sheets of air, capricious in their direction, and often amounting to sharp squalls in their intensity.

I am, Sir, yours very truly, W. R. BIRT.

Observatory, Cynthia Villa, Walthamstow.

P.S.—My article on Atmospheric Waves, contains an allusion to the 'wind-flaws" (on p. 11), such as I conceive the "squalls" of the 19th 'October to have been.—W. R. B.

[As we have not yet received so many of the "copies of any notes which our numerous correspondents may find in their books" as we consider requisite for a full discussion of this remarkable storm, we again defer it, and trust that, reinforced by Mr. Birt's request, ample materials will soon be forwarded. Dr. Barter's return from Bath is a capital type of what is required.—ED.]

THUNDERSTORM ON NOVEMBER 22ND.

To the Editor of the Meteorological Magazine.

SIR,—On the 22nd of November, at 9.3 p.m., there was here a dazzling flash of lightning, accompanied by deafening thunder (together), and instantly a fall of large hailstones and torrents of rain, which ran over the shoots from the house like a waterfall. Query, did the lightning cause the condensation of a cloud—the coldness causing the drops to freeze?—Yours, F. S. AMERY.

Druid Ashburton, Devon.

To the Editor of the Meteorological Magazine.

SIR,—Throughout the evening and night of Nov. 22nd, we had an almost incessant storm of lightning and thunder, with frequent showers of rain and hail. No damage was done in this parish, but at Hartfield, about eight miles to the northward, the spire of the parish church was shattered. The electric fluid struck the ball at the top of the vane, split the top of the spire, ripped out the shingles and some of the timbers on the south side and some of the stones on the top of the tower. In fact the whole of the spire is so severely shaken, that much of it will have to be removed before it can be repaired. The pieces of shingle were scattered all over the churchyard and in the adjoining fields, both north and south. A large piece of timber and shingle fell across a wooden rail placed over a grave near the belfry door, smashing it to atoms. The spire is supposed to be one of five in England, that are clearly of the third pointed date—broach spires, A.D. 1377.

A storm of such severity and duration is of rare occurrence at this season of the year.—Yours obediently,

C. L. PRINCE.

Uckfield, Dec. 4, 1870.

[Reference to the November Notes on p. 199 will show that this storm was felt more or less throughout the south of England.—ED.]

DIFFERENCE BETWEEN READINGS OF MERCURIAL AND ANEROID BAROMETERS.

To the Editor of the Meteorogical Magazine.

SIR,—In your last number, Mr. Knott gives an interesting table showing the difference between the readings of the mercurial and aneroid barometers, during August and the two following months. This variation is, I think, explained by the last paragraph in his letter. "No allowance was made for temperature to the observed reading of the aneroid."

I am not aware whether any compensating principle has been successfully applied to aneroids to correct the errors caused by changes of temperature on metals, and on the elasticity of metal springs. All aneroids that I have compared, show a sensible variation with the rise and fall of the thermometer. Supposing the mercurial barometer to give the correct reading, we should expect the error of the aneroid, which was a plus quantity at the beginning of August, to vanish by degrees, and become a minus quantity, as the season progressed and became colder. This rule seems to have been followed by Mr. Knott's aneroid. Further, I observe that the plus error was greatest during the hot weather, about August 10th. Again in October, it was highest on the 2nd, which according to your monthly table was in most places the hottest day of the month. Again the minus error was great on the 11th, which your table shows to have been generally the coldest day of the month. All this seems to bear out the presumption, that these variations are due to the influence of temperature.

Yours, &c, P. P. PENNANT.

Brynbella, St. Asaph, Nov. 21*st*, 1870.

MAGNIFICENT DETONATING METEOR.

To the Editor of the Meteorological Magazine.

SIR,—The remarkable meteor of Saturday last (19th), reported in the public papers, I observed here, while out inspecting the meteorological instruments at nine o'clock p.m., the night then being very dark and the sky overcast with thick fog, no stars visible. I can describe it thus: "While walking in a northern direction I was instantly arrested by a gleam of intensely brilliant white light, which burst forth with a blinding sensation, such as I had scarcely ever witnessed, producing a brilliant white misty spectrum before the eyes, and illuminating all around. I instinctively turned sharply round towards the point from which the light seemed to emanate, south or south-west, and had a momentary glance of a large circular fiery body or flash, similar to the gleam of a discharge from a piece of heavy ordnance, but more vivid; giving off frizzled fervid like beams or sparks, directed towards the margin, and apparently of the diameter of eight or ten feet. Almost instantly it vanished in several quick repeated flashes like lightning, and of various colours: red, blue, and green predominating. The meteor remained visible only a few seconds and gave then no noise; but in about twenty seconds afterwards a receding roll of rapid discharges was heard in the south or south-west, having a noise like a

distant cannonade, and accompanied with a most peculiar booming sound, similar to the reverberatory sound caused by an earthquake."

It would be about fifty degrees above the southern horizon at the moment of its disappearance. Also I may remark that the large size of the meteor, as apparent to me, must have been produced by the state of the atmosphere diffusing the light emitted. Altogether it was a most imposing object. I have seen several very fine meteors, but nothing equal to this last. DAVID HENDERSON.

Deanston Gardens, Stirling, 22nd November, 1870.

EXTRAORDINARY METEOR.—A correspondent from Carnwath, Lanarkshire, writes: At 9 o'clock on Saturday evening a most extraordinary meteor was observed here. At the time indicated a blazing meteor, of a reddish blue or bright mauve colour, with a brilliant tail or streak behind, suddenly appeared in the northern sky, about 55 or 56 degrees above the horizon, and shooting towards the west through a point a degree or two nearer the zenith than the Pole Star, lighted up the whole heavens with a brilliancy so intense as almost to dazzle the eye. The meteor was observed for about two or three seconds, during which time it seemed to pass through a space of 15 degrees, when, appearing to sweep or bend towards the earth, it burst seemingly without report, into a number of pieces, the blaze at the same time being extinguished, leaving a streak of a dark greenish colour, which was visible for a few seconds, and which appeared to be about 10 degrees in length and half a degree in breadth. The Pole Star was observed to be near the centre of the streak when it faded. In from 80 to 90 seconds after the disappearance of the meteor, a most alarming sound was heard, apparently proceeding from the point where the meteor burst. It resembled thunder at a distance of about 5 miles, and was also like the noise produced by a train when heard passing rapidly over a bridge on a calm frosty night, at the distance of half a mile or so. The sound had also a peculiar "whirr" or "boom," resembling the noise made by an engine having a heavy pressure of steam. Indeed, so dreadful was the noise that every one who heard it afterwards declared they never had felt the same indescribable feeling of awe and fear come over them. The sound which was heard for about 50 seconds altogether, gradually increased in loudness up till about 40 seconds, when it seemed very like the noise produced by the passage of a heavy body through the air close at hand; and at 50 seconds from the time it was first heard the sound suddenly ceased. Was the noise caused by the meteor itself before it burst, or was it produced by the portions into which the meteor was divided, after bursting, falling towards the earth? Supposing the latter to have been the case, according to the rule by which distance is calculated from sound, the distance of the meteor when it burst would be about 18 miles from this place. It may be stated that the weather was calm and the sky cloudless when the phenomenon took place; and that a faint aurora borealis was observed in the northern horizon, which from 9.5 till 10 p.m., overspread the sky from west to east by north, and was of almost all colours—from white to deep red. At 11 p.m. the sky became overcast and rain began to fall.

Another Account.—AIRDRIE, LANARKSHIRE.—About 9 o'clock on 19th, a strange meteoric phenomenon appeared in the heavens. The whole sky was illuminated by a bright light, resembling the lime or magnesium light. All eyes were turned in a north-easterly direction, where a large meteor was seen travelling to the south-west, and apparently nearing the earth in an oblique direction. At first it appeared as a large ball of fire, with a tail resembling a comet. When apparently near the earth, the ball burst, and the light disappearing, left the sky as dark as it was before the meteor was seen, except that there was a small white cloud visible in the direction whence the whole had come. So vivid was the light that an alarm of fire was raised in the neighbourhood of South Street, and several parties were seen running in the direction of the Gas Works, where it was supposed the fire had originated. People who were in quiet neighbourhoods heard, following the appearance of the meteor, a low sound as of distant rolling thunder.

THE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—In compliance with the request of a great many of your correspondents, I have much pleasure in stating the law referred to in my last letter. It is as follows :—

When the rainfall of the first seven months of the year is below 10 inches, (near London or at Lyndon in Rutland), or there have been in the first eight months of the year, three or more months in each of which the rainfall has been below an inch, the succeeding winter is *always* remarkably severe, if the Greenwich mean temperature of August to October inclusive has been not more than 56°·1 in the former case, or in the latter more than 53°·4. The following are *all* the instances relative to this law since 1770. It will be seen that in all these instances the mean temperature of the winter was more than 2° below the average of 99 years, and eleven times in twelve the mean was more than 3° below that long average.

The rainfall amounts of the first seven months in the period from 1771 to 1791, are taken from the tables of Mr. Barker, of Lyndon; those for the period from 1792 to 1796, from the journal of Mr. Adams, of Edmonton; those for the period from 1797 to 1814, from Luke Howard's tables, and the remaining rainfall amounts, as well as the mean temperature values, are from Mr. Glaisher's tables.

The Greenwich rainfall observations only being available from 1815, I was obliged to have recourse to the above-mentioned registers.

TABLE I.

Year.	Rainfall of January to July inclusive.	No. of months below 1 inch from Jan. to Aug. inclusive.	Mean temp. of August to October inclusive.	Period of Winter.	Difference of Mean temperature of winter from the average of 99 years.
	inches.		deg.		deg.
1771...	7·5	...	52·5	Jan. 1771 to Mar. 1771	—3·6
1785...	7·8	...	53·7	Jan. 1786 to Mar. 1786	—3·1
1788...	9·2	...	55·0	Dec. 1788 to Feb. 1789	—3·8
1794...	7·8	...	53·8	Dec. 1794 to Feb. 1795	—6·3
1796...	8·0	...	55·2	Dec. 1796 to Feb. 1797	—4·1
1798...	9·7	...	55·9	Dec. 1798 to Feb. 1799	—3·4
1813...	...	3	53·4	Jan. 1814 to Mar. 1814	—6·5
1829...	...	3	52·8	Dec. 1829 to Feb. 1830	—4·6
1837...	9·6	...	55·4	Jan. 1838 to Mar. 1838	—4·1
1840...	9·3	...	54·3	Dec. 1840 to Feb. 1841	—3·8
1854...	9·7	...	56·1	Jan. 1855 to Mar. 1855	—4·4
1864...	8·2	...	55·7	Jan. 1865 to Mar. 1865	—2·04
1870...	7·1	...	55·5	... ..	...

It appears from the foregoing, as also from the following law, that drought in the first seven, eight, or nine months of the year should be placed among the elements of the problem of the weather for a given winter.

In the following law uniformity of monthly mean temperatures in the spring and summer, instead of a low or moderate temperature from August to October, is connected with deficient rainfall.

When the Greenwich rainfall of January to September inclusive is below the average to the extent of 0·7 inch, or more, and the mean temperatures of April and May are within 2°. of uniformity, or the mean temperatures of any two consecutive months, from the 15th of May to the 14th of August, (reckoning the month from the beginning of one calendar month to the end of the same, or from the middle of one month to the middle of the next), are so nearly uniform that there is a range of not more than 0°·1; the succeeding winter is invariably very severe.

The following table contains all the instances that have occurred relative to this law since 1814. It will be seen that in each instance, the mean temperature of a period of four months, was more than 1°· below the average of 99 years.

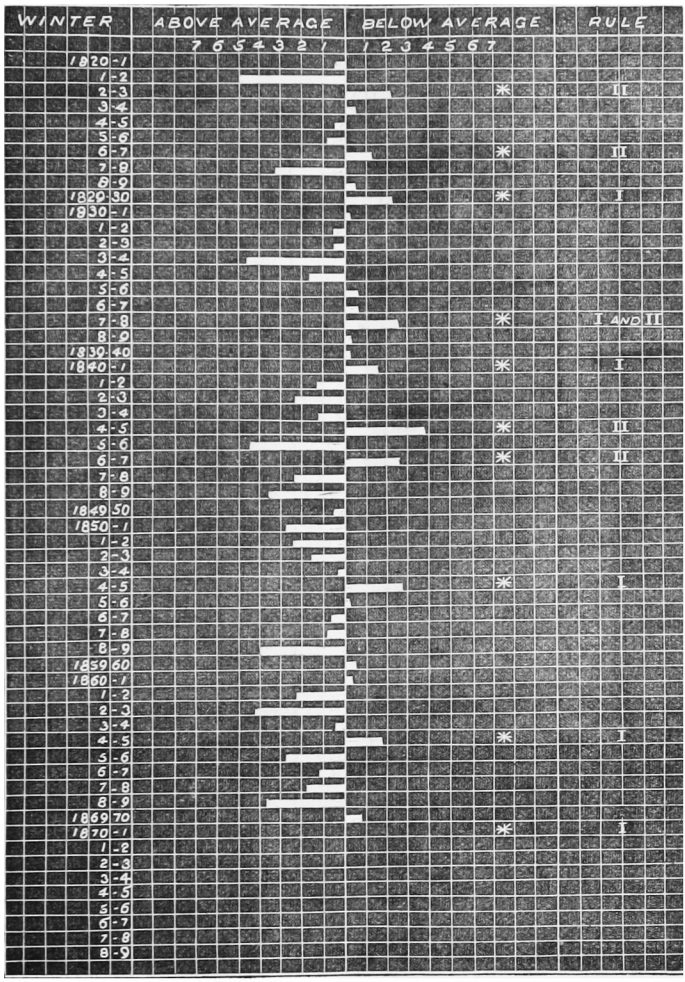
TABLE II.

Year.	Diff. of Greenwich rainfall from average of 55 years.	MEAN TEMPERATURE OF							Difference of mean temp. of Dec. to Mar. inclusive, from average of 99 years.	Year of Winter.
		April	May.	June.	July.	May 14 to June 14	June 15 to July 14	July 15 to Aug. 14		
	inches.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	
1822	—1·2	..	...	62·6	62·5	61·9	61·9	...	—2·2	1822–3
1826	—1·4	49·0	50·0	...	...	...	...	...	—1·2	1826–7
1837	—2·9	...	...	...	..	...	63·5	63·4	—2·6	1837–8
1844	—2·1	51·7	52·9	...	...	...	...	...	—3·9	1844–5
1846	—0·7	..	...	...	...	...	64·6	64·7	—2·6	1846–7

From 1771 to 1820 there were eleven winters when the mean temperature of December to March inclusive was below the average by more than 2°, viz.—the first seven years given in Table 1, and the winters of 1777-8, 1783-4, 1784-5 and 1799-1800. In 1777, 1783, and 1784 the falls of rain in England, were respectively (according to Mr. Symons) 11, 7, and 4 per cent. below the annual average. In each of these seasons, too, there was a very remarkable uniformity in the monthly mean temperatures or in their differences. In 1799, the uniformly low temperature from January to October inclusive, was particularly striking; *every month being below the mean.* It was doubtless this remarkable uniformity that indicated the very severe winter which followed.

The accompanying diagram shows the departure from the average of 99 years, of all the winters in the last half century.

In the diagram the stars are placed against those winters that are mentioned in tables 1 and 2. On comparing the minus departures from the mean with the asterisks, it will be seen that in every past year there is no minus of more than 1° without a star, and no star without a minus of more than 1°. It will also be seen that in the last 50 years there were nine winters, in which the mean temperature was more than 1° below the average, and nine years in which the phenomena mentioned in laws 1 and 2 occurred. The nine years in both cases exactly correspond.



It thus appears that during the last half-century, unusually severe winters have *always* occurred after the phenomena mentioned in the foregoing laws, but have *never* occurred without those phenomena having previously prevailed.

There is one additional fact which it may be worth while to state. It is this—the coldest months in the last hundred years occurred in the winters given in the foregoing tables. December was coldest in 1788, and the next coldest was in 1796. The coldest January was in 1795, and the next coldest was January 1814. February was coldest in 1855; and the coldest March on record (except that of 1785) occurred in 1786. All these intensely cold months occurred in the winters mentioned in Tables 1 and 2.

I think the foregoing statements, diagram, and tables, sufficiently prove the accuracy of the laws to which they have reference.

GEORGE D. BRUMHAM.

Barnsbury,

NOVEMBER, 1870.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade	On grass
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	1·76	— ·65	·75	22	13	56·4	24	27·3	19	8	15
II.		Maidstone (Linton Park)	1·70	— 1·49	·34	20	12	56·0	26	26·0	13	8	...
,,		Selborne (The Wakes)	2·77	— ·77	·72	22	10	52·0	1, 26	22·5	19	17	19
III.		Hitchen	1·29	— ·85	·32	24	14	53·0	24	26·0	16	9	...
,,		Banbury	1·90	— ·30	·34	22	14	52·7	1	23·0	17	14	...
IV.		Bury St. Edmunds (Culford)	·89	— 1·50	·25	12	10	55·0	24	26·0	17	9	19
V.		Bridport	1·86	— 1·30	·48	24	10	57·0	3	22·0	18	13	...
,,		Barnstaple	3·36	— ·78	·55	22	18	58·0	1, 25	33·0	13†	...	...
,,		Bodmin	4·50	— ·48	·86	23	18	54·0	22*	32·0	18	0	7
VI.		Cirencester	2·26	— ·53	·65	22	9	...	...	...	...	...	...
,,		Shiffnal (Haughton Hall)	2·75	+ 1·18	·82	22	18	53·0	24	25·0	17	15	...
,,		Tenbury (Orleton)	2·78	+ ·31	·48	22	15	57·2	24	25·0	17	13	15
VII.		Leicester (Wigston)	1·38	— ·78	·32	23	12	55·0	24	28·0	11	8	...
,,		Boston	1·37	— ·77	·30	24	14	55·5	24	27·5	17	8	15
,,		Grimsby (Killingholme)	1·65	..	·47	23	14	54·0	24	28·0	9§	7	...
,,		Derby	1·99	+ ·36	·57	22	12	57·0	23	28·0	12§	7	...
VIII.		Manchester	2·42	— ·34	...	...	12	..	...	...	...	...	...
IX.		York	1·93	— ·05	·57	23	19	52·5	24	24·0	17	12	...
,,		Skipton (Arncliffe)	3·94	— 2·51	·91	24	9	53·0	25	18·0	17	16	...
X.		North Shields	3·50	+ ·80	·88	9	16	56·0	3	30·0	10‡	8	15
,,		Borrowdale (Seathwaite)	8·00	— 8·67	...	..	...	...	...	...	...	...	...
XI.	WALES.	Cardiff (Town Hall)	...	...	...	...	...	...	...	...	...	...	...
,,		Haverfordwest	3·98	— 1·69	·75	14	12	54·0	1	27·5	19	14	...
,,		Rhayader (Cefnfaes)	3·85	— ·73	1·00	23	10	52·0	...	21·0	...	5	...
,,		Llandudno	2·94	— ·22	·67	20	15	55·4	2	29·6	15	1	...
XII.	SCOTLAND.	Dumfries	2·07	— 1·15	·61	21	13	60·0	3	25·0	10	12	...
,,		Hawick (Silverbut Hall)	1·71	...	·43	12	13	...	...	...	...	...	...
XIV.		Ayr (Auchendrane House)	2·15	— 1·92	·40	19	16	54·0	1, 3	22·0	9, 10	13	21
XV.		Castle Toward	2·52	— 2·12	·64	13	13	56·0	4	26·0	10	12	17
XVI.		Leven (Nookton)	1·55	— 1·49	·43	13	10	58·0	3	25·0	27	15	27
,,		Stirling (Deanston)	1·32	— 2·19	·45	21	12	54·8	3	21·0	8, 9	20	25
,,		Logierait	1·82	...	·46	21	11	...	...	...	...	...	...
XVII.		Ballater	2·94	...	1·00	21	10	52·0	1	22·0	27	21	...
,,		Aberdeen	2·47	...	·37	11	20	50·0	3	29·7	14‖	5	29
XVIII		Inverness (Culloden)	...	...	...	...	...	...	...	...	...	...	..
,,		Portree	10·07	— ·41	1·11	16	21	...	...	..	...	...	...
,,		Loch Broom	4·17	...	·50	12	22	...	...	...	...	...	...
XIX.		Helmsdale	4·74	...	·72	15	25	...	...	...	...	...	...
,,		Sandwick	3·67	— ·33	·41	21	20	53·1	3	31·6	24	1	17
XX.	IRELAND.	Cork	3·33	...	·84	18	13	...	...	...	...	...	...
,,		Waterford	3·78	— ·17	1·17	18	17	54·0	1,3,4	30·0	17	1	...
,,		Killaloe	2·21	— 2·68	·51	18	16	59·0	24	28·0	18	10	...
XXI.		Portarlington	1·04	— 2·88	·27	19	21	53·0	1	27·0	16	9	...
,,		Monkstown	1·41	— 1·48	·40	19	12	...	...	...	...	...	...
XXII.		Galway	4·57	...	1·40	22	16	60·0	2	30·0	17*	5	...
,,		Bunninadden (Doo Castle)	2·56	...	·30	14	20	50·0	7	20·0	26	14	...
XXIII		Bawnboy (Owendoon)	...	...	..	...	...	...	...	...	..	..	..
,,		Waringstown	1·77	...	·28	12	13	57·0	1	23·0	8	12	22
,,		Strabane (Leckpatrick)	2·30	..	·35	15	18	52·0	1, 2	21·0	9	22	29

*And 25. †And 17, 18, 20. §And 17, 18. ‡And 11, 12, 15. ‖And 23.
+ 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; T S for Thunderstorm; R for Rain; H for Hail, S for Snow.

ENGLAND.

CAMDEN TOWN.—Dense fog at noon on 9th; a few flakes of S on the 10th, at 7 a.m.; S also 13th and 15th; T S at 7.45 p.m. on 22nd; gale on 23rd and 24th.

LINTON PARK.—The middle of the month wet and sometimes wintery, but the first 12 days and last five days quite dry; distant T on the 23rd, but few fogs; and perhaps the most remarkable event for November was the dust blowing on the 10th. On the whole it has been a favourable month. Highest reading of bar. 30·21 on the 3rd, lowest 28·75 on the 15th and 22nd.

SELBORNE.—Only one day with R before the 19th; R on every day but three from 19th to the end of month; a few flakes of S at 8 a.m. on 10th; dense fog all day on 9th, and again on 17th and 26th; fogs on 2nd, 3rd, 4th, 11th, 27th, 28th, and 29th; aurora on 21st; T S with H and R on evening of 22nd, and again at 1 a.m. on 23rd, followed by violent wind and R at noon; gale with heavy R on 24th; bar. remarkably low from the 9th to the 25th, then a sudden rise; S on 15th in early morning, which disappeared by noon on 18th.

BANBURY.—Slight S on 13th; fog on 2nd, 3rd, 4th, 9th, 26th and 27th; T and L with high wind on 22nd, and high wind on 23rd also.

CULFORD.—Fog 2nd, 3rd, 5th, the three following days and 26th, and two following days; slight fall of S on 10th, and again on 12th.

BRIDPORT.—T and L on 22nd, nearly all the R fell in eight following days from 19th to 26th inclusive; heavy south-westerly gale on 24th.

BODMIN.—Highest bar. 30·51 on 3rd, lowest 29·08 on 20th; mean temperature of November 42°·9.

SHIFFNAL.—This month has kept up its character throughout, fog or R varied with frost. The prevailing winds up to the 25th were westerly, from which date they came from the E. The temp., with one exception (53° on the 24th), seldom exceeded 45°, while on 15 days it sank below 32°; the bar. high during the first week, from which date it sank considerably, but rose again, terminating the month unusually high, viz., 30·22. Redwings arrived on 6th, fieldfares, in flocks, on 10th; woodcocks unusually scarce up to the end of the month.

[ERRATUM.—In last month's Notes, "Comma Butterfly" was misprinted "Common Butterfly."—ED.]

ORLETON.—The weather very cold till the 21st, with frequent fog, and frost almost every morning, but with very little R; then very warm and rainy till the 26th; cloudy and dry after. Bar. highest at the beginning and end of the month, but very low in the middle; T heard on 16th, 17th, and 23rd, and L seen on 21st and 23rd; aurora at 9 p.m. on 19th; mean temp. nearly 2° below the average.

BOSTON.—R and S on the 10th, 14th, 15th, and 16th.

KILLINGHOLME.—Much fog; temp. colder than usual; many days of calm. Wheat comes slowly out of the ground. Winter began on 10th; S falling again on the 11th, and on the 12th the ground was covered with S. A spot on the sun visible to the naked eye through the fog on the 17th.

ARNCLIFFE.—A fortnight of severe cold weather from the 5th to the 19th.

NORTH SHIELDS.—S, L, and H on 10th; S also on 9th and 11th.

WALES.

HAVERFORDWEST.—Stormy and cold; the middle very wet. Splendid aurora on the evening of the 19th. S fell on six days in small quantities.

CEFNFAES.—The month has been cold and damp, with much wind and fog.

LLANDUDNO.—Though cold on the 11th, there was L in the evening, with H showers; S on the distant hills, continuing to the end of the month; H on 12th and 13th. The aurora seen, more or less, every evening during the week from the 7th to the 12th.

SCOTLAND.

DUMFRIES.—The first eleven days fine, with some frost; from 12th to 25th showery, with occasional frosts; S on the 10th, 11th, and 12th.

HAWICK.—Charming weather till the 9th; very stormy on 10th and 12th; the remainder of the month, on the whole, genial and mild, and both gardening

and husbandry operations are well forward. Curlers were on the ice on the 11th, and enjoyed a game.

CASTLE TOWARD.—The first week calm and comparatively mild; the second cold, with frosty nights; S and sleety showers on the 14th, which lay on the hill tops for some days; the last week fine, with a rising bar.

NOOKTON.—Fine, mild, and calm from 1st to 9th; S showers on 10th; clear, brisk, easterly winds on 11th; meteor at 9 p.m. on 18th; fine from 24th to the end.

LOGIERAIT.—Several heavy fogs, but a fine month.

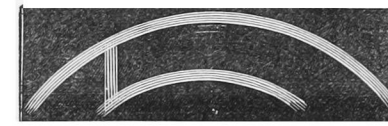
BALLATER.—A sharp S storm about the 10th, and cold throughout.

ABERDEEN.—Red aurora on 8th; S, sleet, and H on the 9th, 10th, and 11th; S two inches deep on the 10th. A rather dry month, but dull, with days colder and nights milder than the average. Mean temp. 39°·4; max. in sun, on 1st 81°·9; min. on grass, 19°·1, on 14th; temp., R, and bar. below the average. Winds generally very light; winds from N., N.W., and S. above the average.

PORTREE.—This month has been stormy and very squally. T and L on 10th and 11th; frost and S from 10th to 19th; no R after the 26th.

LOCHBROOM.—A wet month; not one dry day from the 3rd to the 21st, then two fine days, and then R to the 26th, and very keen frosts to the end, but the farmer has been able to use his plough successfully in preparing the soil for the spring operations.

SANDWICK.—November has been drier than the mean and somewhat colder, particularly during the first part, owing to the prevalence of northerly winds from the 3rd to the 18th, but many days were fine, and the wind generally moderate. Lunar rainbow on the 11th; on the 8th, a curious double rainbow, with a perpendicular pillar of the same colours extending from the end of the inner up to the outer bow; 18th, aurora to zenith and S., red sometimes, wind 40 miles an hour from 10 a.m. to 2 p.m.; wind 40 miles an hour from 5 p.m. on 25th to 4 a.m. on 26th, 50 miles an hour for two hours at first.



IRELAND.

DOO CASTLE.—Fine month on the whole; there were some nights of very severe frost.

WARINGSTOWN.—The first and last weeks fine.

LECKPATRICK.—Very cold month, the coldest for the last seven years; the number of cold nights (as in October) unprecedented. Rainfall about half my average, while October was double.

OZONE PAPERS.

SIR,—I also, as a beginner, went in for ozone, and came to the same conclusion as Mr. Thrustans. Ozone papers, in my opinion, are a delusion and a snare. I have looked at them at 9 p.m., and found them as black as 8, and even more. The next morning they were as white as when first hung up.

More than this, I have hung a paper at 9 a.m., seen it at noon *darkened*. Then came rain and wind, and at 3 p.m. the paper was white again. The stand I hung these papers in was a Stevenson's, into which I thought no rain could get, but I cannot help thinking rain has something to do with it.

I was so disgusted with the whole business that I have not bothered myself about ozone since.—Your obedient servant,

October 24th. HARRY CHICHESTER, F.M.S.

Although our last number was twice the usual size, and contained nearly three times the usual quantity of matter, and we have this month also increased our usual size, the insertion of several esteemed communications is unavoidably deferred.—ED.