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THERMOMETER STANDS.

SINCE last month we have been favoured with several communications on the above subject, some of which we append to this article. Wishing, however, to complete as soon as may be our description of all the leading varieties, we proceed to notice

MARTIN'S STAND.

We do not intend to pledge ourselves that Dr. Martin was the first to adopt the following form of stand, but we think so, and know of no description prior to that which he gave in *The Undercliff*, published in 1849. In the preface to that excellent work he describes with praiseworthy detail the quality and position of all his instruments. He writes :—

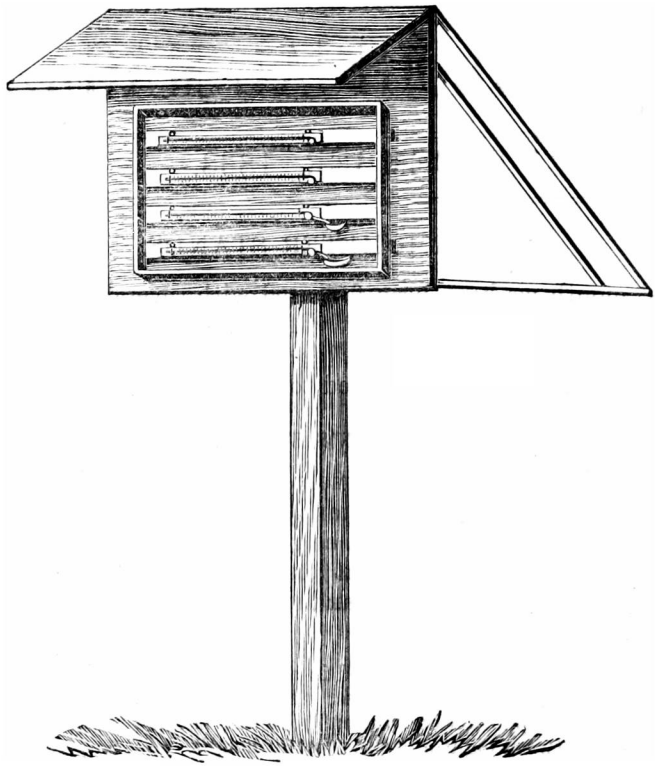
"The thermometers have been placed in a little observatory built expressly in a most exposed, and, for such a purpose, unobjectionable situation. It consists of a thatched roof, supported on wooden uprights, partly resting against a wall, the whole being between eight and nine feet in height.

"At a distance of about six feet from the ground small deal boards are fixed transversely, so as to give each pair of thermometers its proper aspect; and the roof is ventilated by a zinc chimney for the purpose of preventing any accumulation of heated air from affecting the instruments, which are hung upon the deal boards just mentioned, each pair being placed opposite a cardinal point of the compass. There is no building or high ground within a considerable distance, and the whole has been so contrived that the northern pair of thermometers, from which the results given have been derived, can by no accident be affected by radiation or reflection."

When Dr. Martin planned this little observatory, even when ten years later he wrote this description of it, meteorological uniformity had no existence, and this open-sided summer-house with a chimney was a capital scheme. In the Strathfield Turgiss experiments (to the account of which these descriptive articles are an indispensable prefix,) we have reproduced Dr. Martin's stand, with only one exception. The height of 4 ft. above grass has been so universally adopted, that it would be most unwise to think of substituting any other height. Therefore, our Dr. Martin's stand carries the thermometers at 4 ft. above the grass instead of at 6 ft., as he had them.

In other respects, as will be seen from the drawing, it exactly resembles his.

JAMES'S STAND.



This is a copy of Glaisher's, of which we gave engravings and description last month, except that Col. Sir Henry James, R.E., F.R.S., recommends that the thermometers should be attached to a frame in front of the stand, as represented in the annexed sketch, instead of being hung below it, as advised by Mr. Glaisher. The relative advantages of the two methods are on trial. Our readers will notice that four registering thermometers, two dry and two wet, are represented, and that Mason's hygrometer is not shown on Col. James's frame, he recommends that "The hygrometric observations should *be taken from the spirit thermometers.*" The italics are Col. James's, and we reproduce the paragraph from his, in many respects excellent, "*Instructions for taking Meteorological Observations, with Tables,*" which was published in 1860. The general excellence of the work gives additional weight to this bad advice, and we can only express our astonishment at his issuing such an "instruction" in 1860, and warn our readers by no means to follow it. Extreme accuracy and sensibility are indispensable for correct hygrometrical observations, and neither for accuracy nor sensibility are spirit thermometers to be compared with mercurial ones.

To the Editor of the Meteorological Magazine.

SIR,—As I had some share in starting the discussion of this subject in your columns, will you allow me to say that the thermometer stand described by Mr. Glaisher in your magazine for this month appears to me to be quite unexceptionable.

My only doubt is whether the plan of a *revolving* stand would be found to work well in the case of the generality of amateur observers.

In an observatory, where there would be competent assistants always at hand to make the required adjustments, there would of course be no difficulty about the matter. But I imagine that there are many amateurs, who are in the habit of making regular and careful observations of the readings of their self-registering thermometers once in the course of the twenty-four hours, who could not undertake to attend to the management of a stand requiring adjustment several times a day, according to the position of the sun.

I would therefore suggest, as an alternative plan, some modification of the Glaisher stand, such as would shelter the thermometers from the influence of the morning and evening sun, assuming the vertical board on which the thermometers are suspended to be always facing due north. This might be effected by the addition of wings projecting from the two ends of the vertical board, without interfering with the general structure of the frame, which would still be admirably calculated to guard the instruments from all danger of direct solar heat during the midday hours, when the sun's power is greatest. Perhaps your correspondent, the Rev. C. H. Griffith, whom you mention as occupied with a series of experiments in connection with this question, might be induced to make a trial of such a modified stand as I have described, with special reference to determining the differences, if any, between the readings of thermometers in such a stationary stand, and those of similar instruments in a revolving frame of the pattern described by Mr. Glaisher.—I am, Sir, yours truly,

G. T. RYVES.

Nuthall, Nottingham, November 24th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I am glad you have taken up the subject of thermometer stands, for it is one that greatly needs attention.

Will you allow me to say that the Greenwich stand, excellent as it is in other respects, appears to me not sufficiently to guard the thermometers against *heat reflected from the ground.* On an ordinary summer's day, and with the stand placed as it should be on grass, this is of no great consequence, but when long-continued drought has made the grass-plot, as it did everywhere last summer, as bare and brown as a turnpike road, your thermometer might as well be opposite a sunny wall, as four feet above the sunny ground, with nothing to intercept the reflected heat. It seems presumptuous to question the Greenwich observations, but I cannot help thinking that some of the very high maxima recorded there, are partly due to this cause. For several years

I kept my thermometers on a stand made after the Greenwich model, on a breezy lawn some 320 feet above the Thames, with light feathery trees (laburnum, acacia, &c.,) so happily placed that while they kept the grass in shade they allowed the freest circulation of air. Always during that time in hot dry weather, I found, on comparing my weekly maxima with those at Greenwich, as given in the Registrar-General's Report, that if the maximum fell on a bright sunny day, the Greenwich temperature was several degrees above mine, while if the sun was less powerful, they were much more nearly together. I should hardly, however, venture to criticise Mr. Glaisher's arrangements on the strength of my own observations, were it not that the case is so much strengthened by the record at Kew, where (as you will no doubt tell us shortly) the thermometers are enclosed in a cubical box with double sides of louvre-boarding, which, while it admits a free current of air in all directions, guards against all possibility of influence from reflected heat. Thus taking the maxima for the months of July, August and September last, we find the following very great difference:—

	Greenwich.		Kew.
July 22nd	96°·6	.....	90°·2
August 5th	90 ·5	.....	85 ·4
September 7th	92 ·1	.....	86 ·4

which can hardly be due altogether to difference of locality, but must, I think, be partly owing to the cause I have named.

The evil would be, to a great extent, obviated by a horizontal board, 15 inches wide, and as long as the stand is wide, suspended at a distance of a foot below the lower edge of the board B by two strips of wood or metal attached to the ends of the horizontal board. This would sufficiently intercept the heat reflected from below, while it would not interfere with the free access of air to the thermometers.

When you have sufficiently ventilated the subject of thermometer stands, I hope you will take up the various methods in use of calculating daily mean temperatures.—I am, Sir, your obedient servant,

B. W. SMITH.

Hampstead, N. W., November 21st, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to see Mr. Kesteven's letter, and your invitation to meteorologists to offer their opinions on the best method for registering the true shade temperature.

I believe this is a most difficult question, and that much remains to be done to arrive at a just uniformity in recording the maximum shade temperature.

I quite agree with Mr. Kesteven in what he says of the greater heat shown inside the thermometer stands, and in some instances I have observed a difference of *seven degrees* between a thermometer inside the stand (not in contact with the board) and one in some shade outside, the heat having apparently accumulated inside the stand as within an oven,

I am not prepared with any plan to supersede the present stands, though I have no doubt that they would be greatly improved by being covered with a thick straw thatch, and having both sides and bottom open. May we not hope that Mr. Glaisher himself will again turn his attention to this important subject, and suggest some improved thermometer stand that may be universally adopted?—Yours, &c.,

JAMES LIDDELL, Com. R.N.

Bodmin, November 21st, 1868.

MONTHLY CHRONICLE.—NOVEMBER.

On 3rd, about 3.20 p.m., a very bright meteor was seen, during strong sunshine, from Chipping Norton, Birmingham, Rugby, Northampton, and other places; from the bearings given it would seem to have disappeared above the town of Banbury.

On 5th, the transit of Mercury was very well seen, the sky being for November remarkably favourable.

	First contact.				Last contact.		
	h.	m.	sec.		h.	m.	sec.
Leyton	21	0	12·38	...	21	3	5·70
Steyning	20	59	15	...	21	1	45

On 8th, snow 0·1 in. deep in London in the early morning, and near Birmingham three or four inches deep. Very heavy in Switzerland; the *Courrier de l'Isère* states that more than 8000 sheep were buried in snow.

On 9th, three specimens of the parrot crossbill (*Loxia pityopsittacus*) were seen on the Malvern Hills—said to be a sign of a hard winter.

On the 13th, the barometer rose to 30·65, reduced to sea level. The following paragraph appeared in the *Express*, and was copied into several papers:—

"STATE OF THE BAROMETER.

"We feel it is a duty to direct the serious attention of mining proprietors and managers of mines to the extraordinary height of the barometer, which marked 30·65 this forenoon. The greatest caution should be observed during the next few days, for the result of any sudden fall of the barometer would be that the gas, now kept back by the very great weight of the atmosphere, would rush into the workings to the imminent peril of careless miners. The terrible accidents at the Oaks and Talk-o'-the-Hill Colleries in 1866 happened after a sudden fall of the barometer. On the 10th of December the mercury stood at 30·40; on the 11th there was a fall of nearly one inch, and that fall continued till the 13th. During that interval the explosions at the above-named collieries took place. Nearly all serious casualties from fire-damp have occurred when great depression of the barometer has been observed. At such times there is considerable difficulty in obtaining proper ventilation, and as a rule a more than ordinary amount of air should be sent down into the mines. The managers, especially in very gaseous pits, should take care that this precaution is attended to, the neglect of which, under the circumstances indicated, is almost criminal."

On the night of the 13-14th, a very much grander display of meteors occurred than the public had been led to expect; they were mostly large, and though of course not so numerous as in 1866, they were sufficiently so to attract the attention of all persons who were out during the night; 354 were counted at Penzance in 5 hours, of which 146 were seen between 4 and 5 a.m.; the radiant was almost exactly the same as in previous years. At Naples the display was very well seen for Europe,

but of course the grandest was on the Atlantic and beyond it. We annex a Canadian report :—

"THE METEORIC SHOWER.

"Nearly 3000 meteors were counted between 10.45 p.m. of November 13 and 6 a.m. of November 14, Toronto time.

"Excepting between 5 a.m. and 6 a.m. of November 14, the sky was free from cloud, and during the greater part of the time prior to 5 a.m. it was remarkably clear. With the exception of about 1 per cent., the courses of the meteors were from the constellation Leo.

"Many were very large and brilliant, some exceeding Sirius in apparent magnitude, and exhibiting often a variety of colours. Most of them were followed by trains, which often left tracks that continued visible from two to four minutes.

The following table shows the number seen at different parts of the night, together with the state of the sky.

Toronto Astronomical Time.		Number seen during interval.	State of the sky.
10.45	12.0	173	Very clear.
12.0	13.0	329	Ditto.
13.0	14.0	583	Ditto.
14.0	15.0	489	Occasional very light haze.
15.0	16.0	375	Ditto.
16·0	17.0	572	Haze increasing.
17·0	18·0	365	Clouds 0·4, very hazy.
Total		2,886	

"G. T. KINGSTON, M.A., Director.

"Magnetic Observatory, Toronto, Canada, November 19."

On 13th, a cyclone occurred in the Bay of Bengal, and an earthquake in the afternoon at Bucharest.

On 22nd, at 4.30 a.m., slight earthquake at Liverpool.

On 26th, serious colliery explosion at Hindley Green, the barometer having fallen more than an inch in 48 hours preceding the 23rd.

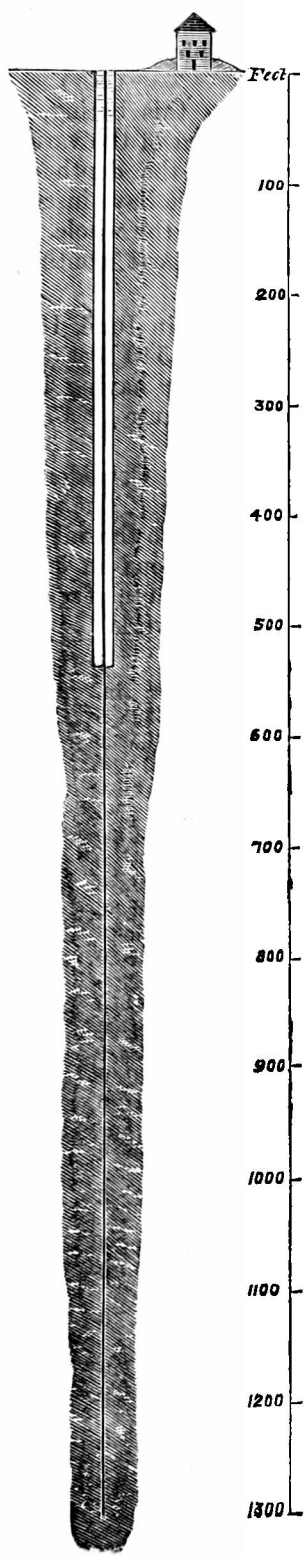
On 27th, another earthquake was felt in Roumania.

TEMPERATURE OF THE EARTH AT GREAT DEPTHS.

THE present state of our knowledge on the above subject may be advantageously recapitulated as an introduction to a brief notice of some rather important experiments just commenced.

If we bury a series of thermometers in the earth so that their bulbs are at the depths specified in the first column, we obtain results approximately given in the subsequent ones.

	Mean Annual Temp.	Hottest		Coldest		Hottest Day.	Coldest Day.
		Month.	Temp.	Month.	Temp.		
4 ft. above ground	49·0	July.	61·8	Jan.	37·9	July 15	January 8
1 ,, ,, ,,	54·8	,,	70·2	,,	40·8	,, 21	,, 20
1 in. below ,,	52·1	,,	65·9	,,	40·5	,, 26	,, 24
3 ft. ,, ,,	50·9	Aug.	62·5	Feb.	41·1	Aug. 9	Feb. 8
6 ,, ,, ,,	51·3	,,	59·3	March	44·2	,, 25	,, 24
12 ,, ,, ,,	50·6	Sept.	55·5	April	46·1	Sept. 25	March 27
24 ,, ,, ,,	50·3	Nov.	52·0	June	48·6	Nov. 30	June 1
100 ,, ,, ,,	50·2	Temperature uninfluenced by seasonal changes.					
200 ,, ,, ,,	51·3						
300 ,, ,, ,,	52·4						
400 ,, ,, ,,	53·5						
500 ,, ,, ,,	54·6						



The thermometer at 1 ft. is in a box which gets very greatly heated, whence its high mean temperature. It will be noticed that the difference between the hottest and coldest month decreases with the depth, and vanishes altogether about 30 ft. below the surface.

The increase of mean annual temperature below 100 ft. has been so variously stated, that no general rule can be laid down; an increase is always found, but the rate of increase varies from one degree in 30 ft. to one degree in 100 ft., and this rate of increase is the subject of the present enquiry.

At the meeting of the British Association at Dundee, Professor Sir W. Thomson moved the appointment of a committee to investigate the temperature of the earth at great depths. The year ending with the Norwich meeting, in the autumn of the present year, was chiefly occupied in arranging the best modes of procedure, and the active operations of the committee may be said to date therefrom. On the present occasion we intend to confine our notice to one set of observations, namely, those which have been originated by Mr. Symons at the site of the late Hampstead Water Works in the Kentish Town Road, about half a mile south of Highgate Hill. A very few words will suffice to explain the origin of the opportunity of which advantage has now been taken. As far back as the time of Henry VIII. the Hampstead Water Works Company was formed, to supply certain villages with water; as time wore on, these villages grew, and eventually all have been united into suburbs thickly covered with first-class houses. The original sources of supply became inadequate, and a well was therefore sunk into the chalk to a depth of some 500 or 600 feet. For some years this yielded a sufficiency, but as both the individual consumption of water, and the number of consumers, increased, the supply again became unequal to the demand. The company, acting on the best advice, resolved to sink an artesian well, through the centre of the old well, down into the lower greensand, generally an abundant source of sup-

ply. The boring was carried down 1300 ft. (a quarter of a mile), but the lower greensand was absent, no water was obtained, and the company was ruined.

As considerable geological interest is attached to this boring, we have reprinted from a scarce blue book an exact account of the various strata. We add also a section, giving some idea of the depth and details of this celebrated well, in the sketch of which we have inserted a house, 50 ft. high, as an indication of the scale of the whole. A description of the proposed experiments shall be given next month.

ARTESIAN WELL AT KENTISH TOWN.

"The new boring at Kentish Town was commenced in June, 1853, from the bottom of the old well, which had been sunk 540 feet deep. The work was abandoned at the end of 1855, no water having been obtained, even at a depth of 1302 feet, and an expenditure of £7500 having been incurred.

"The result of the undertaking was most unexpected. Considerable discussion has arisen among geologists as to the nature of the strata which have been met with, and much interest attaches to the subject. We are enabled by the courtesy of the engineer to append an entire section of the strata. It would be of importance to the cause of science if any means could be found for the continuance of the work.

Section of the Boring at Kentish Town.

				ft.	in.	Depth. ft.	in.
Tertiary Strata, 234 ft. 6 in.	*London Clay* (236 ft.)	1.	Yellow clay	30	6		
		2.	Blue clay, with *Septaria*	205	6		
	Woolwich and Reading Series (61 ft. 6 in.)	3.	Mottled (red, yellow and blue) clay ...	37	6		
		4.	White sand, with flint-pebbles ...	0	6		
		5.	Black sands; *passing into*	2	0		
		6.	Mottled green and red clay	1	0		
		7.	Clayey sands	3	0		
		8.	Dark-grey sands with seams of clay ...	9	6		
		9.	Quick-sands, ash-coloured	6	6		
		10.	Flint-pebbles	1	6		
	Thanet Sands (27 ft.)	11.	Ash-coloured sands	10	0		
		12.	Argillaceous sands	4	0		
		13.	Dark-grey clayey sands...	11	0		
		14.	Bed of angular green-coated flints ...	2	0	— 234	6
Chalk, 586 ft.	*Middle Chalk with flints* (244 ft. 6 in.)	15.	Chalk with flints	119	6		
		16.	Hard chalk without flints	8	0		
		17.	Chalk, less hard with few flints ...	31	6		
		18.	Nodular Chalk, with three beds of tabular flints	13	6		
		19.	Chalk, with seams of tabular flint and a few nodular flints	32	6		
		20.	Chalk, with a few flints and some patches of sand	9	6		
		21.	Very light-grey chalk, with a few flints	30	0		
	Lower Chalk without flints (294 ft.)	22.	Light-grey chalk, with a few thin beds of chalk-marl subordinate	133	0		
		23.	Grey chalk-marl, with compact and marly beds and occasional pyrites ...	161	0		
	Chalk-marl (47 ft. 6 in.)	24.	Grey marl	20	0		
		25.	Harder grey marl, rather sandy and with occasional iron-pyrites... ...	27	0		
		26.	Hard rocky marl	0	6	— 910	6

		ft.	in.	Depth. ft.	in.
Upper Greensand (72 ft. 6 in.)	27. Bluish-grey marl, rather sandy; the lower part more argillaceous... ...	58	9		
	28. Dark-green sand, mixed with grey clay	13	9—	983	0
Gault (130 ft. 6 in.)	29. Bluish-grey micaceous clay, slightly sandy	39	0		
	30. Ditto, with two seams of argillaceous greensand	6	7		
	31. Micaceous blue clay	84	11—	1113	6
188 ft. 6 in.	32. Red and yellow sands, and sandstone	1	0		
	33. Compact red clay, with patches of variegated sandstone	4	0		
	34. Pure dark red clay	4	7		
	35. Red clay, whitish sands, and mottled sandstone ...	3	0		
	36. Hard red conglomerate, with pebbles of syenite, greenstone, trap-rock, quartz, hornstone, red claystone-porphyry, and fossilliferous schist, well rounded, and varying in size from a marble to a cannon ball ...	2	0		
	37. Micaceous red clays, mottled in places	26	0		
	38. Seams of white fissile sandstone and red sand	3	8		
	39. Mottled sandstone	0	4		
	40. Red sand and sandstone with small pebbles and *Belemnites*, and a few small phosphatic nodules	2	0		
	41. Seams of red sandstone and white sands	4	0		
	42. Pebbly red sands, and fissile sandstone	1	0		
	43. White and red sandstone	5	0		
	44. Fine light-red sands	2	9		
	45. Hard fissile sandstone	0	3		
	46. Very fine light-red sand	4	0		
	47. Pure red clay	2	0		
	48. Red and mottled clayey sands, with some iron-pyrites	1	3		
	49. Red sandy micaceous clay with fissile sandstone ...	2	5		
	50. Compact hard greenish sandstone	10	0		
	51. Very micaceous red clay	1	0		
	52. Grey and red clayey sands	1	1		
	53. Light-coloured soft sandstone with fragments of *Ammonites*	2	1		
	54. Red sand and sandstone (highly inclined ?)	6	2		
	55. Greenish sandstone	4	0		
	56. White and grey clayey sands, with iron-pyrites ...	2	0		
	57. Reddish argillaceous sands, with seams of sandstone ...	3	8		
	58. Micaceous red clay...	18	4		
	59. Seam of greenish sandstone	0	5		
	60. Red mottled and micaceous clay, with patches of light-coloured sand and fragments of *Ammonites* and of a *Scaphite*	14	6		
	61. Red compact micaceous clay, with *Belemnites*	20	0		
	62. Red quartzose and micaceous sandstone	2	0		
	63. Brownish-red clayey sand and sandstone	4	0		
	64. Very hard micaceous sandstone, with small pebbles of white quartz	4	0		
	65. Light red argillaceous sand	10	0		
	66. Red sandstone, micaceous and quartzose	8	0		
	67. Light red clayey sands (with small angular fragments of chert or flint ?)	2	0		
	68. Whitish and greenish hard sandstone (horizontal ?) ...	6	0—	1302	0

(*To be continued.*)

REGISTRATION OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to suggest another mode of dealing with thousandths of an inch of moisture, besides the one given in your editorial note at the foot of Mr. Griffith's letter. I would suggest that thousandths of an inch should be entered on the register as they are measured, but that they should not appear in reports containing only hundredths except so far as they go to swell the total amount of rainfall for the month. Thus, if ·007 fell one day, and ·003 on another, blanks would correspond to these days in tables accurate only to the hundredth of an inch, but the two falls together would appear in the total for the month, as they together amount to ·01. This plan is open to the objection that in such tables the total would not exactly correspond with the sum of the figures whose total it appeared to be.

The plan you suggest seems to me open to a more serious objection than the above. Thus in the above supposed case, if the ·007 be returned to the gauge, and ·003 should fall on that day or night, the next morning you will find ·01 in the gauge, and that day will be set down as one of the days on which ·01 has fallen, while in reality only two very minute quantities should have been registered. It seems to me hardly fair to credit one day with ·01 when the moisture may be due to the aggregate infinitesimals of several days, on none of which ·01 has in reality fallen.—Yours obediently,

J. M. DU PORT.

Mattishall, Norfolk.

[The remarks on this subject on page 180 (and in which we fully concur) were in type before Mr. Du Port's letter arrived. We object *in toto* to returns which do not balance—*i. e.*, in which the sum of the daily entries differs from the monthly totals: how could such be checked? We cannot, therefore, accept Mr. Du Port's suggestion. One observer sends in returns professing to give the depth of rain to the hundredth thousandth (0·00001) of an inch; surely no one would advocate counting such a day as a day of rain. Theoretically, Mr. Du Port is quite correct in objecting to the "aggregate infinitesimals" not having a right to appear as 0·01. But practically—and surely that should guide us—we do not see a better course than that we pointed out. Those who have been measuring only to tenths of an inch object to the delicacy of hundredths, and those who have been dealing, or thinking they deal, with hundred thousandths, or even thousandths, dislike the coarseness of hundredths, and between the two are the vast majority of observers, who believe that if we know the depth within the thickness of a sheet of paper, we know it near enough.

We hope that Mr. Du Port and Mr. Vernon will consider what we have above stated, also the remarks on page 180, the references to the subject in the various volumes of *British Rainfall*, the inevitable

roughness of many of the gauges, to which we believe we may add as a fact that no rain of less than one-twentieth of an inch ever raises the water in a reservoir, or reaches the London sewers, unless the ground was previously in a saturated state, no engineering publication recognises thousandths of an inch, nor do either of the Meteorological Societies, nor does the Meteorological Office.

Both Mr. Du Port and Mr. Vernon are able men, both have only one object in view, that of securing the best results; each would surely be unwilling to disturb a rule once generally adopted, unless it was evidently mischievous. We are, therefore, very sorry to differ from them, but at present we fail to see that their suggestions would lead to anything but confusion.—ED.]

REVIEWS.

Proceedings of the Literary and Philosophical Society of Manchester. Vol. VII., Nos. 7, 9, 10; Vol. VIII, No. 2. 8vo.

IT is impossible to do more than briefly indicate the subjects discussed in these valuable papers. Two of them are mainly devoted to solar radiation, and as we hope before long to treat that subject in some detail, we postpone the consideration of those articles for the present. Mr. Baxendell contributes a criticism on Mr. J. P. Harrison's paper in the "Monthly Notices" of the Royal Astronomical Society, entitled "Inductive Proof of the Moon's Insolation," and also Mr. Glaisher's paper "On the Influence of the Moon on the Direction of the Wind," in the Proceedings of the Meteorological Society, 1867. Mr. Vernon contributes a note on the rainfall of 1867, and in the following sentence objects to the decision which Mr. Symons based upon the practice of the majority of observers, and which has been accepted throughout the length and breadth of the land:—

"It would seem that in our district we can safely reckon upon having rain on an average of about 180 days in the year, or that rain falls on about half the days of the year. Of course this includes every day upon which a measureable amount of rain falls, and it is only right that every day on which rain falls, and can be measured, ought to be included, notwithstanding Mr. Symons' limiting the amount to days only on which the fall reaches 0·010 inch. In 1867 there were no less than 16 days on which rain fell less than 0·010 inch in amount, and to leave these out must vitiate the result. Moreover, in places where the rainfall is much less than here, there will probably be a much greater number of days upon which a daily amount of 0·010 inch falls. Every day upon which a measureable amount of rain falls ought to be given, and if for any other purpose a limit in amount is wanted, it ought to be tabulated separately."

When a very large number of gentlemen have been for some years working at any given subject without the means of intercommunication, it is probable they will vary considerably in their modes of procedure; when they have consulted together and come to a definite system of working, and when that system has been approved by all the leading publications on the subject, we consider that such a

decision should only be called in question on really weighty grounds of objection.

We have no desire to re-open the question of what constitutes a rainy day. Ninety-nine observers out of a hundred accept 0·01 as the rule, and we trust they will not swerve from it, for if they do, we shall have a worse chaos than before it was agreed to and established.

Those who take any interest in the matter, can trace its progress in *British Rainfall* 1863, 1864, &c. We prefer to leave it with one parting remark. Mr. Vernon says, "Every day upon which a measureable amount of rain falls." What constitutes a measureable amount depends entirely on the construction of the gauge. It is probably possible to make a gauge which would record the rain drops formed by the condensed steam of a passing locomotive, and there are many useful and trustworthy gauges which will not show less than a tenth of an inch. Which is to be taken, or is the number of days to depend on the form of gauge used? With every respect for Mr. Vernon, we hold that he has not shown adequate ground for disturbing the decision arrived at some years since.

The last of these papers is a very elaborate discussion of ozone observations in all parts of the world by Mr. Baxendell, wherein he states that the discussion of the returns "has suggested to my mind the idea of a belt of ozonized air in the middle latitudes of our hemisphere, which has a motion to the northward during the spring months of the year, and a return movement to the southward during the autumn months, and that its mean position for the year varies with the increase or decrease of solar spot frequency, or with the increase or decrease of the disturbances in the earth's magnetic elements."

Results of Meteorological Observations taken at Christchurch, Hokitika and Bealey, Canterbury, New Zealand, for the year 1867, by R. L. HOLMES, Esq., Government Observer. Folio, 10 pages, large folding tables.

MR. HOLMES is going steadily on, pushing his stations into the interior, and obtaining very valuable results. His new station at Bealey (lat. 171° 37′ E., lon. 43° 2′ S., height above sea 2100 ft.,) is almost as wet as Hokitika, the rainfall apparently averaging nearly, if not quite, 100 inches per annum. A vacuum black bulb max. arrived at Christchurch in September, 1867, and was laid on grass in a slightly sheltered spot. On December 30th this instrument read 156°. Unfortunately, along with this valuable addition to the apparatus, arrived a "thermometer in rays of parabolic reflector," but we think there is little fear of Mr. Holmes abandoning his old grass minimum for the sake of this new arrival. At any rate we beg to assure him that at present there is nothing better for observations of terrestrial radiation than a delicate spirit minimum thermometer on grass.

NOVEMBER, 1868.

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° on grass
			inches	inches.	in.							
I.	ENGLAND.	Camden Town	1·03	— 1·38	·40	22	11	59·3	1	25·4	7	8
II.		Staplehurst (Linton Park)	1·78	— 1·41	·53	22	12	56·0	2	25·0	7	10
,,		Selborne (The Wakes)	2·44	— 1·10	1·05	22	7	62·0	22	19·0	20	12
III.		Hitchen	1·10	— 1·04	·42	22	15	58·0	1	25·0	6	9
,,		Banbury	2·07	— ·13	·67	21	15	57·0	1	25·0	7	12
IV.		Bury St. Edmunds (Culford)	1·37	— 1·02	·36	22	12	59·0	1	23·0	6	8
V.		Bridport	2·83	— ·33	·93	21	11	57·0	1	24·5	6	10
,,		Barnstaple	2·21	...	·89	22	15	57·5	2	32·0	27	0
,,		Bodmin	7·85	+ 2·87	1·99	21	16	59·0	22	32·0	7†	...
VI.		Cirencester	2·23	— ·56	1·03	22	6?	53·0	1	32·0	7	0
,,		Shifnall (Haughton Hall)	1·14	— ·43	·18	22*	14	60·0	1	24·0	7	9
,,		Tenbury (Orleton)	1·91	— ·56	·53	25	13	63·6	1	24·8	6	...
VII.		Leicester (Wigston)	1·36	— ·80	·38	22	9	53·0	22	22·0	5, 28	11
,,		Boston	1·32	— ·82	·25	22	19	61·0	1	28·0	7	6
,,		Gainsborough	...	..	...	...	...	...	...	...	...	...
,,		Derby	1·06	— ·57	...	...	12	60·0	1	26·0	7, 9	...
VIII.		Manchester	3·11	+ ·35	·92	3	15	58·7	1	26·5	7	6
IX.		York	2·04	+ ·06	·56	23	17	65·0	1	24·0	29	8
,,		Skipton (Arncliffe)	6·42	— ·03	1·75	3	16	59·0	2	30·0	7	1
X.		North Shields	2·23	— ·47	·47	22	23	64·0	1	26·6	7	6
,,		Borrowdale (Seathwaite)	9·43	— 7·24	1·80	1	16	...	...	...	..	...
XI.	WALES.	Cardiff (Town Hall)	1·47	...	·60	21	8	...	...	...	...	...
,,		Haverfordwest	4·74	— ·93	1·10	30	9	56·5	1	25·0	11	13
,,		Rhayader (Cefnfaes)	2·91	— 1·67	·70	4	12	55·0	...	23·0	...	..
,,		Llandudno	2·78	— ·38	·96	22	14	63·6	1	34·1	25	...
XII.	SCOTLAND.	Dumfries	2·26	— ·96	·33	30	12	55·0	3	25·5	7	6
,,		Hawick (Silverbut Hall)	2·08	...	·36	2, 3	14	...	...	...	...	...
XIV.		Ayr (Auchendrane House)	2·54	— 1·53	·80	2	12	60·0	1	18·0	7	13
XV.		Castle Toward	4·08	— ·56	·86	3	11	57·0	1	17·0	7	19
XVI.		Leven (Nookton)	1·25	— 1·79	·46	30	12	58·0	1	26·0	7	8
,,		Stirling (Deanston)	3·11	— ·40	·69	2	15	57·8	1	19·5	7	17
,,		Logierait	3·14	...	·81	29	9	...	...	...	...	..
XVII.		Ballater	2·19	...	·38	29	20	59·0	1	17·5	7	12
,,		Aberdeen	1·58	...	·59	30	17	60·0	1	28·1	7	16
XVIII		Inverness (Culloden)	1·31	...	·38	14	...	55·4	1	27·5	7	9
,,		Fort William	5·43	...	1·51	2	15	...	...	...	...	...
,,		Portree	6·02	— 4·46	1·56	28	15	51·0	13	25·2	9	12
,,		Loch Broom	4·52	...	1·15	2	16	...	...	...	...	...
XIX.		Helmsdale	3·32	...	1·04	2	16	...	...	...	...	...
,,		Sandwick	2·66	— 1·34	·60	2	20	55·0	1	26·0	9	8
XX.	IRELAND.	Cork	5·83	...	2·50	29	13	...	...	...	...	...
,,		Waterford	4·58	+ ·63	1·41	29	18	58·0	3	31·0	8	3
,,		Killaloe	2·35	— 2·54	·35	29	17	58·0	1	24·5	24	6
XXI.		Portarlington	1·67	— 2·25	·42	30	25	60·0	1	28·0	7	7
,,		Monkstown	3·48	+ ·59	·75	29	20	58·0	21	29·5	25	...
XXII.		Galway	2·63	...	·65	29	16	50·0	2	30·0	9	4
,,		Bunninadden (Doo Castle)	4·58	...	1·00	30	15	50·0	3, 12	25·0	10‡	12
XXIII		Bawnboy (Owendoon)	3·96	...	1·00	29	19	57·0	1	26·0	23§	8
,,		Waringstown	2·57	...	·65	29	17	62·0	1	22·0	6	11
,,		Strabane (Leckpatrick)	4·70	..	·78	25	19	56·0	2	24·0	9‖	16

* And 25th. † And 10th to 12th. ‡ And 14th, 16th, 24th & 27th. § And 24th, 26th & 27th.
‖ And 10th & 24th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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 PARK.—High winds on the 2nd, 3rd and 22nd. A little S on the 8th; the dust blowing so as to be troublesome on the 1st, 3rd, and 4th, an unusual thing in November; fogs frequent, but not dense; wind mostly N.; bar. high till 20th, when it became unsteady.

SELBORNE.—The bar. was higher on the 13th than since the 19th March, and lower on the 22nd than since the 20th of April; prevailing winds from the 6th to the 20th N. and N.E., afterwards S. to S.W.; tempestuous wind on 4th and 5th; L on 21st at 10 p.m.; T with violent wind and R on the 22nd; white frosts on 6th, 7th, 8th, 16th, and 30th.

BANBURY.—Slight fall of S on 7th and 10th; high wind and low bar. on 22nd.

CULFORD.—Slight S on 7th; high wind 3rd and 4th; altogether a very mild and favourable November.

BRIDPORT.—S on 7th; bar. very high at the middle of the month, 30·65 on the 13th, but 29°·00 on the 22nd; several meteors seen between five and six a.m. on 14th, and a little L [?]; fine month to the 19th; heavy gale sprang up on the 20th, which lasted to the 22nd.

BODMIN.—Hawthorn in blossom at Wadebridge, six miles distant; second crop of pears and strawberries in my garden. On 21st 1·99 of R in 15 hours.

CIRENCESTER.—A rather cold month, with very little sunshine; gale from S.W. on 3rd; wind from 6th to 22nd chiefly N., N.E., and E.

HAUGHTON HALL.—First four days unusually mild, when a sudden change took place on the 5th, with storms of R and sleet; on the night of the 6th-7th an inch of S; the rest of the month alternate R and mist; on the 21st a sudden change of temp. from 39° to 50°, with falling bar. from 30·01 on the 19th to 28·61 on 22nd, accompanied by a severe storm on the night of 21st. The oaks retain their leaves this year later than any other tree, they still remaining at the end of the month; few berries on the hollies, abundance on the hawthorns; woodcocks unusually scarce, also few fieldfares and redwings; immense flocks of green plovers—the farmers best friend.

ORLETON.—The 1st very warm, followed by a great wind on the 3rd and 4th; cold but dry, with frequent frosts, much cloud and fog, to the 20th, then much warmer, with R, cloud and fog to the end. Bar. reached 30·37 on the 13th, and fell to 28·75 on the 22nd. On the night of 6th S fell, covering the earth one inch deep; temp. of the month nearly one degree higher than the average.

WIGSTON.—An unusually fine calm month; the temp. rather below the average, as well as the rainfall.

BOSTON.—Fine month on the whole, with temp. above the average; severe frosts on the 6th, 7th and 8th, with ice on the pools nearly two inches thick; gales from the S.W. on 3rd and 22nd; misty weather during the last week.

DERBY.—Rainfall rather below the average; the month has been one with little or no fog. The drought of summer is yet unrelieved so far as the springs are concerned, all are low, and many which then entirely failed continue still in the same state, and unless we have an abundance of R or S to relieve the want, the canals in this district will soon cease to be available for the traffic.

ARNCLIFFE.—An unusually high gale on the 3rd; the great fall, 1·26, of the bar. between 19th and 23rd was not followed by any particular storm, beyond a heavy fall of R.

NORTH SHIELDS.—H on 4th, 7th and 9th; S on 6th and 9th; lunar halo 25th and 28th.

SEATHWAITE.—A very cloudy month, with N.E. winds.

WALES.

HAVERFORDWEST.—Mild and damp until the 4th, then a sudden change to severe weather; considerable fall of S, the Precelly range completely covered, on the 6th; the weather then cleared, with sharp frosts until the 19th; after which, to the end, the weather was very stormy, cold and wet. Wind principally from

the N.W., E., and S.E. ; heavy gales on the 21st, 22nd, and 30th ; bar. fell from 30·362 at 9 a.m. on 20th, to 28·897 (corrected) at 9 p.m. on the 22nd.

CEFNFAES.—A cold tempestuous month ; wind generally S.E. or N.E. ; second crops of many garden vegetables, and spring and summer flowers in bloom.

LLANDUDNO.—At 6 p.m. on 5th, one tremendous peal of T, with L and H ; lunar rainbow at 8.30 p.m. on 21st.

SCOTLAND.

DUMFRIES.—The first four days were stormy ; from 5th to 20th frosty and fine ; the close of the month wet ; S on the 5th, 6th, and 25th ; temp. rather below the average ; the weather on the whole fine for November, with less than the usual amount of fog and gloom.

HAWICK.—A remarkably mild month ; the hills were covered with a thin coating of S from the 5th to the 10th, but there have only been seven days on which we have had any frost, and that of so slight a nature as only to remind one of winter.

AUCHENDRANE.—The polar and equatorial currents nearly divided November between them, and the winds were not violent, except on 3rd from W., on 21st from S.W., and on 30th from W. and S.W., when gales occurred ; bar. is about the mean of the last three Novembers, and the temp. considerably below; the weather was cloudy, but the number of rainy days less than the mean of the past 12 years.

CASTLE TOWARD.—The month has been gloomy, cold and frosty ; the winds chiefly N. and N.E., the hills being covered with S.

NOOKTON.—Gale on 3rd ; squally on 30th ; fine in middle and at end of month.

DEANSTON.—The first four days wet and windy ; from 5th to 22nd bright and frosty, with a little S on the 6th ; the last week dull, damp and windy ; between 3 and 5 a.m. on 14th many meteors seen.

LOGIERAIT.—Very keen frost from 6th to 21st ; heavy rains at the beginning and end of the month.

BALLATER.—A sharp snowstorm on the 5th ; S lying on the ground for a week after which, weather open to the end of the month ; rainfall four-fifths of an inch under the average of the last eight years ; temp. also below the average.

ABERDEEN.—A dull, dreary, cheerless month, dry and not cold, but far from comfortable. Days much colder and nights warmer than the average ; much more than average of N.W. winds, but of less force. Auroræ on 6th, 7th, 8th, 15th and 23rd ; silent L [?] and many meteors on morning of 14th.

FORT WILLIAM.—A good month on the whole ; about the average rainfall, two-thirds of which fell in the first week ; from the 6th to the 10th inclusive there was hard frost ; S.W. gales on the 2nd and 21st.

PORTREE.—First week very cold and stormy, with heavy squalls, S, sleet and R ; afterwards the weather cleared up, and generally continued frosty until near the end of the month, when R, sleet, and S with high winds again came on ; but on the whole the month was favourable for cattle grazing ; all the crops have been housed in wonderful good condition, though much later than usual, even in this part of the country.

LOCHBROOM.—Very high winds and heavy rains on the 2nd, continuing to the 7th, when a severe frost commenced, continuing more or less to the end of the month, giving us beautiful weather for the season, but doing great damage to the tender grass and to the potatoes still unlifted, which were many of the best in the country.

SANDWICK.—November has been very dry and cold ; both the rainfall and temperature being far below the mean, the latter 3°·4 ; sleet on the 1st ; gale, 40 to 45 miles an hour, on the 2nd ; S on the 5th, 6th, 7th and 8th ; auroræ on 6th, 8th, 9th and 16th ; sun pillar on 14th, meteors seen at 6 a.m.

IRELAND.

DOO CASTLE.—Fine from 8th to 20th, with some severe frosts ; beginning and end of the month exceedingly wet and disagreeable ; T S with H on the 5th ; 17th to 19th inclusive remarkably dark days.

OWENDOON.—A fine open month ; S on 4th.

WARINGSTOWN.—R and gale on 3rd ; beginning and end of month unsettled, middle fine and bright.

LECKPATRICK.—Middle of the month very fine ; sharp frosts every night ; bar.

highest in the year, 30·75 (corrected), on the 13th; from that time it fell gradually to 28·86 on the 21st; from that date to the end of the month stormy and wet; S on the 6th; 34 frosty nights since the 1st of October, this has never been observed here before; grass min. 18° on 10th.

[ERRATUM IN AN ERRATUM.—The correction notified last month against Owendoon really belonged to Doo Castle.]

THE INTENSITY OF STORMS REFERRED TO A NUMERICAL VALUE BY THE CALCULATION OF BAROMETRIC GRADIENTS.

To the Editor of the Meteorological Magazine.

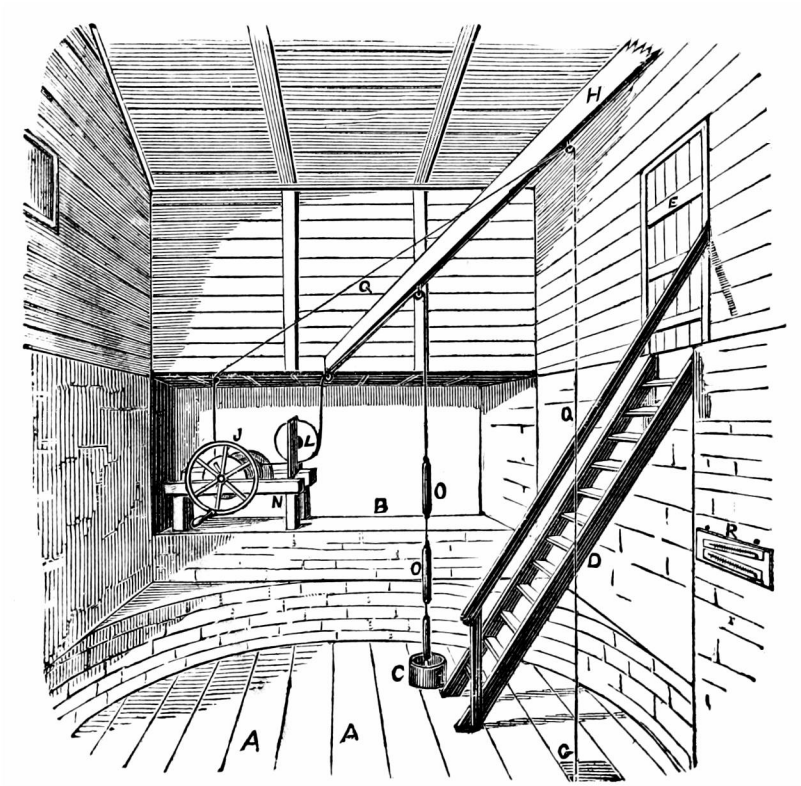
SIR,—Will you allow me to point out an error as to date, and also as to facts into which your reviewer of Mr. Scott's report has inadvertently fallen.

He there limits my claim to the employment of the term *Barometric gradient*. This is altogether a mistake. What I chiefly claim is *the first proposal to express the relative intensities of storms numerically by calculating Barometric gradients.* This proposal was first published, not in 1868 as stated in the review, but on 26th June, 1867, at the public General Meeting of the Scottish Meteorological Society, and the substance of it was also published in the journals of the day. If, therefore, the intensities of storms were ever reduced to a numerical value and published by any meteorologist previous to June, 1867, my claim falls to the ground, but not otherwise.

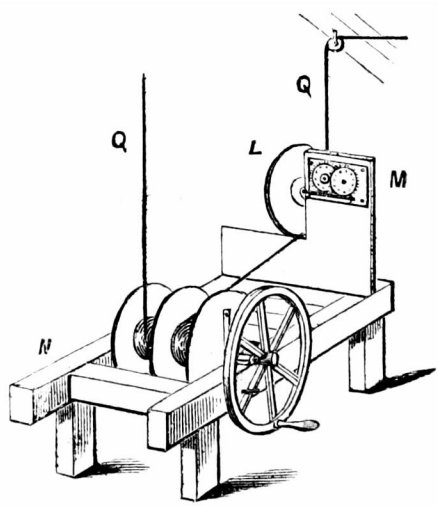
Permit me to observe that the first proposal of a method of reducing any natural phenomenon to a numerical value is far from being unimportant.—Yours very truly, THOMAS STEVENSON.

SIR,—I have received the proof of Mr. Stevenson's letter, and in reply beg to state that it fails to convince me that either of the statements in the review are "errors." I am not, however, able at present to *prove* that anyone had previously proposed "to express, &c.," although Thom and others have gone very near it, and I *think* some one has actually proposed it; still I may be wrong. Now as to the date. I did not state that it was first published in 1868. My words were, "a term suggested by Mr. Thos. Stevenson, C.E., in the *Journal of the Scottish Meteorological Society* for January, 1868." As I heartily concur in the concluding paragraph of Mr. Stevenson's letter, I think it may be beneficial to point out the strange complication of dates connected with this matter. I received on the 8th of April, 1868, the Journal dated January, 1868, (which by the bye is stated to be "for the quarter ending *September 30th*, 1867.") In this Journal I first saw Mr. Stevenson's paper, which was stated to have been read at the General Meeting, June, 1867. At the middle of the paper is a note dated February, 1868, and at the end a P.S. dated February 19th, 1868, and these in a publication dated *January*, 1868. I may add that in no part of the paper is there any intimation that it had been previously printed, and I therefore do not see that I was in error in avoiding all complication by taking the date of (reputed) publication, which was three months earlier than I received it.—I am, &c., YOUR REVIEWER.

KENTISH TOWN WELL.



OBSERVING ROOM.



WENDING APPARATUS.