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RAINFALL STATIONS.

WITH the observation to be made at 9 a.m. on the first of January next, will end the second decade of systematic rainfall work, and immediately afterwards the third decade will begin.

What changes the coming decade has in store no one can tell; several hundred of our correspondents will cease observing; the direction of the organization may pass from my hands; but I believe that the utility of the careful registration of the fall of rain will be increasingly recognised as years roll on, and that either by myself, by a successor, by some society, or by Government, the work will undoubtedly be continued.

This being my belief, what is my duty, and that of all who wish to render our organization in all respects more powerful? I think there are only two things to be done—to obtain more observers and to obtain more money.

Additional Observers.—Complaint has been made that with a staff of more than 2,000 observers, it is unreasonable to ask for more. I will state a few facts which will explain and illustrate the necessity:—

(1). The deaths average 30 per annum; this alone would, therefore, diminish the staff by 300, or 15 per cent. in the ten years.

(2). There are many removals; many observers who, from various causes, are obliged to discontinue their records; and a few, very few, who do so voluntarily. The records terminated by these classes together probably exceed those terminated by the death of the observers; and when we add records spoiled by accidents to the gauges, by fire, and the many other vicissitudes which come to my knowledge, I am inclined to believe, (*a*) that it would be unwise to calculate that more than 800 perfect records for the decade 1880-89 would be obtained from the present staff of observers, and (*b*) that if no fresh observers were obtained the staff in 1889 would not much exceed 1,000.

(3). Even with the present far larger staff, we have not a proper representation of the country. For instance, North-east Yorkshire, South and also South-west Denbigh, North Anglesea, North-east

Pembroke, North Brecknock, and South Radnor greatly need additional stations. The following counties have only one station in each, viz., Clackmannan, Kinross, Carlow, Kildare, Roscommon and Monaghan; and, lastly, the Isles of Alderney and Sark and the County of Longford are without any station at all.

(4). As we know by experience (see, for example, *British Rainfall*, 1871, page 8) that even a county well provided with stations may in a few years be left almost without any, it is not merely desirable that the districts above mentioned should be provided with additional observers, but that additions should also be made in many other localities.

(5). Hence it appears desirable that from 100 to 200 new observers should be obtained, and that they should begin observing on December 1st, so as to be thoroughly used to the work before the beginning of the new year.

I need hardly say that I shall cheerfully accept help from any quarter, and that I am quite ready to render any assistance in my power.

Additional Subscribers.—The cost of the rainfall organization has not only grown with its growth, but has grown faster, because the work has become more thorough, at the same time that there has been a larger number of records to examine. Any one who will take the trouble to compare the annual volumes of *British Rainfall*, will find that the brain-work requisite for the compilation of the later volumes far exceeds that for the earlier ones. And so, what with paying for assistance, for printing, engraving, and postages, the total outlay is very large. Upwards of 1,000 observers do not contribute a single penny towards this outlay, and therefore it falls more heavily upon the 1,000 or 1,200 who not only observe, but contribute towards the cost of reducing and printing their observations. Death, however, is constantly lessening the number of subscribers, and therefore new ones must be obtained. I should have preferred that some one else should make this request; as long, however, as the system remains without endowment or Government assistance, the losses by death must be made up, and this year there are not only the average deficiencies from that cause, but in addition many subscriptions have been withdrawn in consequence of commercial and agricultural depression; in fact, this has been so serious that I have been obliged to abandon several stations in mountain districts which I have hitherto kept up by paying shepherds, gamekeepers and others for making the observations.

On all these grounds I ask for additional observers and additional subscribers.

G. J. SYMONS.

THE WEATHER IN OCTOBER.

THE unsettled weather which, during the last ten days of September was general or nearly so, continued during the first four days of October. On the evening of the 1st the barometer was rising and the weather fine, but on the following day several slight depressions passed across these Islands, causing

showers and unsettled weather in many parts. On the 3rd the sky was clear over France and the S.E. of England, while elsewhere the weather was cloudy; moderate to fresh W. winds prevailed all over this country, and the bar. was rising briskly except in the north of Ireland; where a rather brisk fall had set in, but the disturbance which was the cause of it proved to be of but small importance. The bar. consequently continued to rise generally, a large anticyclone was formed over France and the south of England, while the weather became fine and settled with light S.W. to W. winds.

The weather during the week (5th-11th) was very quiet. A rather brisk fall was reported on the morning of the 5th in the south of Ireland, with a S.E. gale in the south-west of Ireland; but the anticyclone which lay over Great Britain, the North Sea, and the Netherlands subsequently spread out over the whole of these Islands and their neighbourhood, so that while E. winds of moderate strength prevailed over France, and N.W. winds over Sweden and Norway, very light breezes or calms were reported from these Islands. The sky, though cloudy and foggy during the mornings and evenings, was clear and bright generally during the early part of the week; but towards the close of the week the fog and gloom lasted through the day.

The next week's weather may be divided into two kinds. At first an area of high pressure extended from Ireland eastwards as far as North Germany, so that while W. breezes prevailed on our northern coasts, over the North Sea, and in Scandinavia, E. breezes blew in the south of England and over France. The weather during this period, which lasted until the morning of the 14th, was dry, though foggy and dull, with low temperature. On the 14th a depression passed southward along our east coast, and N. winds prevailed generally, with cold, raw weather; and these conditions continued, in a lesser degree, throughout the 15th. On the 16th a sudden change began; a brisk fall of the bar. occurred at Stornoway with a S.W. gale, and as the depression which caused the decrease passed over, S.W. to W. gales were experienced on all our more N. coasts, with a rapid increase of temp. On the 18th the bar. was rising quickly, the disturbance passing away eastward, and the wind (still blowing strong to a gale) had veered to N.W. or W., and at night temp. fell again quickly. On the next day a fresh fall appeared at Stornoway, the wind again backed to S., temp. rose, and there was every appearance of a renewal of the gale.

The weather continued unsettled during the following week, and considerable changes occurred. At first the weather was controlled by a large depression, which advanced from the W., passed to the northward of Scotland, and travelled across Scandinavia. During the first few days W. winds, strong to a gale, were experienced, with high temperatures; but on the 20th N.W. gales prevailed, and temp. fell fast, while on the 21st fine, bright, cold weather with moderate N.W. breezes was reported. On the 24th a large depression was shewn to the northward of Scotland, and a small subsidiary over the Irish Sea, the bar. was falling quickly, and the weather dull and rainy, but next day, when both disturbances had apparently travelled away eastward, the weather cleared and became fine and bright. By the evening of the 24th pressure was rising fast in the north, and a complete reversal of the pre-existing conditions seemed probable.

This probability the weather of the next few days proved a certainty, pressure increasing everywhere, and a large area of high readings being shown over Scandinavia and our north coast on the 27th, which by the 28th had shifted to the east of England, the North Sea, and the south of Scandinavia, the weather in the meantime being for the most part dull, or misty and showery. The area of high readings in the north of Great Britain maintained itself till the close of the month, and the weather continued cloudy or dull. Temperature during this period was very variable, the highest temp. in these Islands being in the S.W., and the lowest in the N. or N.E.

Temperature during the first ten days of the month was low, and the rest of the month was subject to sudden and extensive variation.

Lowestoft.

H. E. M.

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LIGHTNING CONDUCTORS.

To the Editor of the Meteorological Magazine.

SIR,—In the summer of 1878 delegates were nominated by the following societies, viz., the Royal Institute of British Architects, the Society of Telegraph Engineers, the Physical Society, and the Meteorological Society, for the following purpose :—

“To consider the possibility of formulating the existing knowledge on the subject of the protection of property from damage by electricity, and the advisability of preparing and issuing a general code of rules for the erection of Lightning Conductors.”

The delegates have held several meetings, and have already collected, firstly, from the manufacturers of Lightning Conductors, and secondly, from the Members of the Royal Institute of British Architects, a large amount of thoroughly practical information. Several of their number are also engaged in forming abstracts of the salient features of the literature of the subject.

The Members of the Conference are, however, most anxious that their report should be as trustworthy and as exhaustive as possible, and they have therefore instructed me to ask you to assist them by publishing this epitome of their proceedings, and allowing them to invite correspondence upon the points mentioned below.

I am, Sir,

Your obedient servant,

G. J. SYMONS, F.R.S.,

Secretary to the Conference.

*Lightning Rod Conference,
30, Great George Street, S. W.*

CLASS OF FACTS MOST REQUIRED.

Full details of accidents by lightning, stating especially whether the building struck had a conductor or not. If there was a conductor, state its dimensions—construction—mode of attachment to building—whether its top was pointed—distance of its upper terminal from the place struck—nature and extent of the connection between the conductor and the earth, and whether the earth was dry or moist—whether the conductor was itself injured—and whether the conductor or the point struck was the most salient object in the vicinity. Information is also desired, either verbally or by sketches, as to the position of metal spouting and lead roofing relatively to the point struck, and to the conductor.

Details of the thickest piece of metal melted by a flash of lightning are much needed.

Unimpeachable evidence of the failure of conductors is much desired, as such failures would be extremely instructive.

BIBLIOGRAPHY.

WE are very glad to report that Prof. Cleveland Abbe has completed his card catalogue of the meteorological papers indexed in the Royal Society's catalogue. Mr. Wheatley, the Secretary of the Index

Society, announces this fact in *Nature* of October 30th, and we hasten to bring it before the meteorological world at large. Surely the United States Government, which is so wisely liberal in all that relates to publication, will at once direct that this catalogue, which would be of world-wide utility, shall be printed. We know few pieces of work which would reflect more credit on the United States Signal Office, and on all who have had a share in the work.

And even if the Signal Office is unable to publish it, the Regents of the Smithsonian Institute will surely not neglect an opportunity precisely consonant with the intentions of the founder of that noble institution.

We sincerely hope that before another year has passed we shall be able to tell our readers not merely that the meteorological papers are catalogued, but that the catalogue is printed.

As to the catalogue of meteorological books, *i.e.*, separately published works, we have no later intelligence than that given in our June number.

REVIEWS.

The Collinsville Tornado of April 14th, 1879. By J. L. R. WADSWORTH, M.D., and F. E. NIPHER. [From the Trans. of the Academy of Science of St. Louis Vol. IV., No. 1.] 8vo, 20 pages and two maps.

A FULLY worked out description of one of those destructive tornadoes which years ago were regarded as being chiefly fiction founded upon fact, but which the careful records of the United States Signal Office and such documents as the present prove to be sad realities.

Dr. Wadsworth's personal narrative of the storm is as follows :—

"At 2.35 p.m., St. Louis time (definitely known), I was aroused by an exclamation from Mrs. W., and simultaneously our help cried out, 'The mill has blown up!' (referring to a planing-mill in a lumber-yard on the block west of us). We immediately sprang to the window (open south) and saw lumber, shingles, great sections of wooden sidewalk, limbs of trees, flying through the air; and so very thick did the air seem to be filled, that it was impossible to see across the street. Rushing to the door, the air was still filled with fine debris of leaves, pieces of old shingle, bark and twigs, borne along with a strong wind accompanied by a little rain. Passing out to the street, it was absolutely impossible for vehicles and very difficult for pedestrians to clamber over the great piles of rubbish, composed of trees, fences, wooden walks, lumber, &c. For three-fourths of a mile down the main street of our little town lay the work of this terrific force. After traversing this distance, we returned to extend the examination in the other direction, and not until we had passed our first starting-point two blocks did the return current coming from the north reach us, bearing a tremendous storm of hail and rain, accompanied by a terrific electrical display. Would judge the storm continued unabated for 45 minutes.

"Finally, as the result of not far from one minute's work, we find in Collinsville 109 buildings more or less injured (24 entirely, 25 partially swept away or crushed, and 60 slightly injured), and involving the loss of one human life and seven wounded. Such is a brief view of the tornado. Although severely felt by those who suffered by it, yet, in comparison with many others that

have occurred in this and adjoining States, this exhibited much less force and was followed by much less loss of life and property."

As regards damage, most of the details are of the usual kind, and need not be reproduced here; the following is novel, but the mechanical force exerted was probably less than in some of the other cases :—

"A horse and buggy, standing in front of a church in which a funeral was being conducted, was taken up into the air and whirled 260 feet distant, and dashed to the ground, killing the horse and but slightly injuring the buggy. Some by-standers claimed that this horse and buggy were carried fifty feet high."

We are rather surprised to find that the authors appear to regard the outbursting of buildings as an unusual phenomenon. They write, "an interesting phenomenon in connection with the tornado, and covering a large proportion of the destruction attending it, comes from a peculiar 'explosive action,' " and then Prof. Nipher adds the following note :—

"This is sometimes attributed to rarefaction of air outside of the house, the unbalanced internal pressure throwing the walls outward. To say, under the conditions which obtain in a tornado, that there is a tendency to rarefaction at the centre of the vortex, is equivalent to the statement that the wind is blowing.

"In case of a vortex approaching a building, the intruding wind would cause a great pressure on the windward side of the house, and the pressure on the lee side would be less. The breaking of a window on the windward side would transmit the pressure to the interior. The support of the side walls would cause the lee wall to be most vulnerable. The side walls might also be started outwards, and the reverse winds, after the tornado has passed, would tend to throw the remaining walls outwards. The violence of the wind would, of course, determine the distance to which the ruins would be scattered."

Our own impression is that there is an enormous up-draught in the centre of every tornado, which diminishes the pressure upon the air in houses to such an extent as thereby to produce the "explosive action" above mentioned.

The Weather and Climatic Changes, by OBSERVATOR. Longley, Warwick-lane, London. 1879 : 16mo. 74 p.p.

A QUEER little pamphlet, of which the following is the preface :—

"This little Book is not intended "to supply a long felt want," nor put forth at the request of "numerous friends." The writer ventures to submit what may, at first, appear a novel theory on the change of climate ; and, in addition to his own observations, he has collated, from the accumulated weather-lore of past ages, such rules as may prove useful to those who believe that "to be forewarned is to be forearmed ;" for the all-absorbing subject, "The Weather," has long continued to cause us more anxiety than all our money, or the want of it."

The novel theory referred to above appears to be that the recent exceptional weather is due to the increased consumption of coal and the diffusion of the gaseous products of its combustion. We also note, as another suggested cause of climatic change, "the friction and displacement of the air caused by constant locomotion over 20,000 miles of railways," and "in support of this theory," the author

"would cite the comparatively unchanged character of the climate in the north of Scotland, where railways and gas only partially exist, and the humidity and enormous rainfall in Glasgow and neighbourhood, where these influences are largely developed."

We do not know what exceptional weather, or what change in the humidity and rainfall of Glasgow "Observer" desires to explain. If he desires to indicate that the rainfall and humidity of Glasgow have increased *pari passu* with the increased manufacture of gas and the extension of the railways, he should submit evidence to prove it. But we think it more probable that "Observer" possesses that dangerous property, "a little knowledge," and, having evolved out of his inner consciousness the theory as to gas and railways, he has recollected that Glasgow has the reputation of being a wet place, and has put the theory and the fact together, forgetting that to make out his case he ought to prove that the rainfall of Glasgow since (say) 1840, is greater, relatively to the less populous districts of Scotland, than it formerly was. Need we add that the rainfall of Glasgow is less than half that of the vicinity of Loch Katrine, and other places far from either gas works or railways.

Fortunately, very few pages are occupied with this theory, and the rest of the pamphlet is one of the queerest collections we have seen for a long time, and reminds us of the strangely mixed notices which are the result of pasting up a series of cuttings from newspapers. Running down the contents, we may mention—Soap bubbles—Trees and Forests—Schwabe's theory of Sun-spots—Commercial Depression—Candlemas—A Boy's Kite—Dr. Packman's forecasts (By the bye, they seem rather unlucky. We write this Nov. 10th; Dr. Packman forecasted as follows: "Nov. 3, Storms; 7 to 10, Floods." Our impression is that a calmer and drier period than the past ten days has hardly occurred for a twelvemonth; in London there has not been a tenth of an inch of rain)—Dean Alford's Greek Testament—Nebulæ—Protoplasm, &c.

The author is very careless respecting the spelling of names; in the table of contents we have Dawe's, Fitzroy, Symond's, Condomine, Smythe, Baddom, and Rowbottom—but with all its faults the pamphlet is worth its trifling cost.

THE SANITARY INSTITUTE AT CROYDON.

At the recent autumn meeting of the Sanitary Institute, one of the three days was appropriated to papers upon Meteorology, Geology, and Geography. This was a recognition of the practical bearings of meteorology, of which meteorologists may be somewhat proud, and with the papers contributed, both the writers and their fellow-workers may be quite content. As the section was presided over by Mr. Symons we cannot offer in these pages any remarks upon his address, but it is so rare to find any one pointing out the practical applications of meteorology, that we believe our readers will not object to

the reprinting of those portions of it which bear most closely upon those relations.

ADDRESS BY G. J. SYMONS, F.R.S.,

Secretary Meteorological Society; President of Section III.

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I, therefore, purpose taking the branches of science mentioned on our programme, and pointing out some of the points of contact between these branches of science and Sanitary practice.

METEOROLOGY.

Let us take, first, temperature. Meteorologists can't tell us the range of temperature to which we are liable in this country; but who will point to even one house so constructed as to resist equally well, extremes of heat and of cold? As regards the majority of houses, built solely in order to be sold, it is patent to everyone that this consideration is entirely neglected. The walls are so thin that they allow the internal temperature in summer to run up to eighty degrees or more, and in winter down far below freezing. There is rarely any outlet for the foul and heated air when it has found its way up the staircases; landlords never think of providing outside Venetian blinds, and the rooms which face the sun become veritable heat-traps. Everybody knows that foul and heated air ascends, and yet (owing to the rare adoption of French windows) nineteen-twentieths of all the rooms in England have no outlet within eighteen inches or two feet of the ceiling, where, consequently, there is a permanent stratum of foul and heated air; and, as if with a desire to aggravate this evil, a quantity of gas is burned in the rooms, and the deoxygenized air rises into this stratum, and remains there. Perhaps, if it were possible to compel every builder to remain for an hour with his head close to the ceiling of the rooms he built, an alteration would not be long deferred; unless, indeed, the foul air killed them all. Everybody knows all this, but few, indeed, are the cases in which any attempt is made to remedy the evil.

In cold seasons it is equally discreditable to hear on all sides complaints of the inconveniences arising from frozen water-pipes, and from their leakage when a thaw follows. If the temperature in England ran down to twenty or thirty degrees below zero, there would be some excuse for such occurrences, but our winters are never so severe.

This reminds me of another case in which a little meteorology would have saved several hundred pounds and much inconvenience. An engineer laid out the waterworks of an inland English town, and either from economy or want of experience, he put his mains only one foot below the ground. He made no inquiries as to the temperature of the soil at that depth. A great frost came: the temperature at one foot went below thirty-two degrees, and so large a proportion of his pipes was burst that it was virtually a case of new mains throughout the town.

Another winter accompaniment which has occurred for hundreds of years is always a source of great confusion—I mean a heavy fall of snow. No one seems to know what is to be done, and the last idea is in many respects the worst. The tramway companies introduced the plan of scattering salt in order to dissolve the snow, and the owners of private houses have imitated them by scattering salt on the pathways in front of their houses. The result is, that the pavements are covered with rotten slush of an excessively low temperature, so cold as to lame dogs temporarily when passing over it, as to be injurious even to the well-shod, and almost unbearable to the shoeless wanderer. It would be very little trouble to sweep this soft slush into the gutters, and I think that any one using salt and not removing the resultant slush, should be not only *liable to a small fine*, but should infallibly *be fined*.

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Excuse this digression, and allow me to return to the more direct relations

of meteorology with Sanitary matters. People of the *cui bono* class are, I believe, yearly becoming more rare, but there are thousands still who would doubt what possible use it could be to know how many miles of wind blew over Greenwich yesterday; and a still larger number would fail to see what possible bearing such a fact could have upon Sanitary matters. Mr. Haviland would tell us that both the direction and strength of the wind ought to be considered in laying out the plan of a town or of large additions to existing ones, and in the past, if not in the present, great care was taken that country residences were protected from objectionable winds by belts of trees. There is, however, a still closer connection, for the members will not have forgotten that this Institute is, and has been for a long time, conducting a series of experiments upon the effectiveness of several patterns of cowls, and that these experiments have been conducted with anemometers and air meters at the Meteorological Observatory at Kew.

Moreover, questions of ventilation, both for public buildings and especially for hospitals, are almost wholly determined by means of small air meters, which are merely delicate anemometers.

Lastly, it is a rather curious fact that upon the summit of that modern Tower of Babel, the Queen Anne Mansions, Mr. Hankey has put an anemometer. I wish he would put another in the court-yard, and publish the records of both. Joking apart, I hold that if premises are to be carried to that height, the streets must be proportionately wider; for the air in a street of ordinary width, but with buildings of that height on each side, would scarcely ever be changed; its only purification would be by the passage of such portion of the rainfall as escaped falling against the houses. The notion of walking through a future London composed of streets of their present width, and houses as high as Mr. Hankey's, is the reverse of agreeable.

Take, again, ozone. I am not going into the chemical question, nor the strictly meteorological one; but in spite of all the demonstrations of the inutility and inaccuracy of the old-fashioned ozone test-papers, I think that they were giving us more useful information than we seem likely to obtain from the more scientific methods which have been declared to be alone of any use. We want some rough-and-ready test of the purity and healthiness of the air in different localities, but at present I know of none. The old-fashioned ozone test-papers had, doubtless, a multitude of faults—I have attacked them somewhat vigorously myself, and Dr. Cornelius Fox still more so; but unfortunately the arrangement which he proposed to substitute was so elaborate, that at the present moment I do not know of a single place in the whole of the British Isles where it is at work. Faith in the old plan has been shattered, and the new one has not been adopted. Perhaps it may be well to epitomize the old method and its faults, as it may lead some one to suggest a safe and simple course.

And first, as to the method. Sheets of absorbent paper were dipped in a solution of iodide of potassium and starch, dried, cut into small strips, made into bundles, and sold in boxes. Observers were instructed to take one out each morning, hang it up in a place open to the air, but shaded from light and of course from rain, and on the following morning to note the amount of discolouration by comparing it with a series of ten pattern-tints supplied with each box of papers; if there was no discolouration the entry was 0, if the paper was rendered quite a dark brown the entry was 10, and intermediate numbers for intermediate discolourations.

So much for the method; now for the faults. The discolouration is effected by the contact of air with the paper; therefore, if on two days the amount of ozone in the air is the same, but the wind blows twice as strongly on one day as on the other day, it is obvious that the discolouration will also be double. This difficulty can be overcome in two ways—(1), by applying to the observed discolouration a correction corresponding with the total horizontal motion of the wind, as recorded by an anemometer placed near the ozone paper; or (2), by sheltering the test-paper from the wind and drawing a measured volume of air over the paper by an aspirator. The papers after exposure and colouration may, by the action of antozone or damp, be bleached before the usual hour of

observation, and whereas 7 may have been reached some hours previously at the regular observation hour the paper may only show 0 or 1. The late Dr. Lankester proposed to get over this difficulty, and also to determine the variation in the amount of ozone during the twenty-four hours, by using the paper in long strips, and winding it by clockwork from one drum to another under a small aperture. I do not think that he arranged his machinery with an intermittent motion, so that each portion should be exposed for some definite period—say, an hour, and then suddenly replaced by another portion, and so on, but that would obviously be the proper course.

There are many other imperfections charged against the old plan; but I will mention only two others. The papers were said not to be equally sensitive, and therefore the recorded discolourations were not strictly comparable. I believe that this ground of complaint arose chiefly from the very limited demand for the papers, and from the fact that there was so much jealousy among the opticians that, instead of all buying from one source, each tried to make his own. I have left the most serious charge to the last. Chemists of high position said that there was no certainty that the discolouration was in the least degree due to ozone, and, I believe, proved their case by tinting the papers by half-a-dozen processes when no ozone was present. Perhaps, however, we shall find that the papers give us useful information, even if they tell us nothing about ozone.

In this, as well as other countries, the public attention given to scientific work is not proportional solely to the merit of the work, but is dependent on two factors: A, the social and scientific status of the worker; and B, the merit of the work. Meetings like the present tend greatly to diminish the value of the factor A, and I sincerely hope that before long it will vanish entirely, and leave the factor B, the merit of the work, as its sole credential. You may wonder at the insertion of this digression; but it was induced by my having resolved on now mentioning, for the first time, a few experiments which I made nearly five-and-twenty years ago.

I arranged with friends residing in various parts of the metropolis—one in the City, one at Whitehall, others at Chelsea, Notting Hill, Blackheath, Camden Town, and Camberwell—for three months' continuous observations of the amount of ozone. We took all the steps that we could to secure uniformity, even taking the precaution of cutting each ozone slip into portions, so that all the stations used the same slip on the same day. At the end of the month the portions were returned to me and mounted as one slip for each day. That they in the least indicated the amount of ozone I am not going to assert; but this I can safely say, that no matter from what direction the wind blew, the papers in that quadrant of the metropolis first reached by the wind were always more darkly tinted than those in the centre or in the opposite quadrant: those at the central stations were scarcely ever tinted. Similar results were, I believe, obtained by Mr. Glaisher during the cholera epidemic in 1854, and though no special arrangements were made to ensure identity of paper, I do not think that the accuracy of the results was thereby vitiated. These very simple and inexpensive tests may be beneath the contempt of the optimists of ozone observers, but they at least prove that there is some quality in air coming from the country to the metropolis which is extracted, not only before passing over the whole of London, but even before passing over half of it, otherwise the central stations must sometimes have recorded traces of discolouration.

That there is a wide difference in the healthiness of different localities is indisputable, and that there is more in it than is revealed by either barometers, thermometers, hygrometers, rain gauges or weathercocks, is equally certain. Something may be learned by the chemical analysis of large volumes of air; something, indeed a good deal, is being learned at Paris by drawing a stream of air over glycerine and examining microscopically the particles of dust deposited. But we want something more handy. It is too bad that there should be no easy means of determining the relative life-supporting properties of the air in Hyde Park and Seven Dials. I do not for a moment say that the old-fashioned ozone papers will do it, but they are the nearest approach which

has yet been made, and I should be very glad if they can be supplanted by something better.

Mists and Miasma.—Before proceeding to consider mists in their relation to public health, I take one moment to say that if any of my hearers have ever seen in this country the presiding genius of mists—I mean the *ignis fatuus*, or “Will o’ the Wisp,” I shall be greatly obliged by their favouring me with full particulars. I only make this request because, in the course of long search, I have not met with one person who has seen it; and I am sure that, especially after the present soaking season, drainage operations will proceed so rapidly that future opportunities will be rare indeed.

Here, however, we are concerned with mists and their influence upon health. You, doubtless, remember the remark of the country doctor, who, walking up a hill, passed from the valley mist into the clear air on the hill-side, and turning to his companion, remarked that that white sheet covered all his best patients. I wish we had statistics of the mortality in some of our old monasteries—Fountains, Tintern, or Rievaulx—for the localities are equally noticeable for their beauty and their mists; and although the regularity of the monastic life might conduce to longevity, I should have thought such damp localities very ill-adapted for such residents. It is often suggested that our ancestors were stronger than we are, and that, as much of their time was spent in the open air and in hunting, they were less susceptible to the Sanitary evils of their houses and castles. But the monks, even those who were not actually studious, did not lead by any means an equally active, open-air life. Were they, then, able to throw off the effects of damps and mists, or did they fall victims to them without knowing the cause? We, however, with all our nineteenth-century artificial and high-pressure life, know perfectly well that a “lovely spot embosomed in trees and encircled by hills” is usually characterized by a damp, misty, cold, and stagnant atmosphere. We know that these conditions are not adapted for vigorous health; and yet how many persons will rush blindfold into the arms of the doctor, simply for the sake of a pretty view! Persons generally select residences, and the sites for new ones, when the weather is fine and the sun shining. There is no reason for their discontinuing the practice; but many selections would, I think, be abandoned, if they would spend an hour or two of the twilight and night in examining the distribution of the mists in the locality. When we remember that few persons spend less than half their time indoors, it is surely not asking very much to urge than an hour or two should be devoted to examining roughly the conditions of the air which will in future surround them for half their lives.

You may think that I attach undue importance to mists, and I will, therefore, give you a short chapter of personal history. A relative had a great desire to spend his autumn holiday in a beautiful, hilly, and well-wooded part of England. Unable to obtain quarters on the high ground, he was induced to take a very clean little cottage on low ground; not, however, very near the river which ran through the little town. At first, four of the family went down, and three of them were speedily attacked with diarrhoea; another relative followed, and was similarly attacked; and finally I arrived myself. I was told of the state of affairs, and advised not to touch the water—on which all the blame was laid. The last train had left; and, moreover, I felt desirous of investigating the case. After dark we went out for a little stroll, and found the air excessively damp; in fact, there was a white sheet over the whole place. Next morning, I was as ill as the rest of the party. I had with me some permanganate of potash, and tested the water from two or three sources with it; but the colour remained absolutely unchanged; so I suppose there was not much the matter with the water. One of the party started off after a doctor; the doctor was out, but the assistant said directly, “Oh, no; it is not the water; strangers are almost always attacked like that; but they soon get better, or else they go away. You see,” he added, “this valley is supposed to have been under sea water not long ago, and all the fields from here to the coast are terribly misty and ageish.” I need hardly add that it was not many hours before the whole party migrated to a high

dry and sandy soil ; but it was only by sleeping in the locality that the evil was incurred, and had we only seen the spot by day-light, scarcely a suspicion of evil would have crossed anyone's mind.

Closely connected with the existence of mists is the amount of evaporation, —a subject upon which we are in nearly the same unsatisfactory condition as I have explained to exist respecting ozone. Some very elaborate, rather costly, and I believe extremely important observations upon this subject, were commenced more than ten years since, and have been conducted under the supervision of Mr. Rogers Field. We are still waiting for his full report on the subject, but it is understood that all the old forms of evaporator are useless, and no new pattern has been introduced in their place. The only two points of contact between evaporation data and sanitary work which occur to me are —(1), that evaporation data would be serviceable in computing the yield of storage reservoirs, a point upon which I believe no information is published, and not much exists ; (2), data as to the amount of evaporation would be very useful in connection with sewage irrigation, for it ought evidently to be most successful where the air absorbs the largest amount of surplus moisture.

Hygrometry is almost identical with the measurement of evaporation, but not quite ; because hygrometry considers the amount of moisture in the air at rest, and evaporation is the resultant of the passage of a variable number of miles of air of a variable hygrometric condition over a water surface. I am afraid this point is hardly clear : I will therefore put it in another form. The air we breathe is, you know, a compound ; there is first an approximately constant quantity of oxygen, hydrogen, &c., and secondly a very variable quantity of water in the invisible state of vapour. It is the business of hygrometers to tell us how much water there is in the air. It is never very great, fifteen grains of water in a cubic foot of air is the extreme, perhaps a trifle beyond the extreme, which ever occurs in this country, while it may run down to one grain per cubic foot. The hotter the air is, the more water can it contain, and hence the high temperature always given to drying-rooms ; and hence it follows that though a room may be dry while it is kept at a high temperature, it will very likely become damp when the temperature falls. A striking illustration of this is reported to have occurred at a ball in Russia. The night was cloudless and very cold, but the room in which the ball was being held was, as is usual in that country, close and hot. A lady fainted ; and as fresh air could not easily be obtained, the windows being frozen fast, an officer broke the glass with his sword. The clear cold air rushed into the room and cooled that inside so rapidly, that the vapour became mist, the mist became frozen, and snow was formed in the room.

Some people err the other way, and especially in cases of illness, distress the invalids, and check their recovery by allowing the air to become too dry. I suppose matters may change in the next generation, but at present either a doctor or a nurse would be considered a pedant who used a hygrometer in order to regulate the air breathed by a patient. I am glad to see that we are progressing in that respect. Two generations back the subject of the hygrometry of the sick-room was unknown. Twenty years ago a paper spout on the nozzle of a tea-kettle was the most advanced apparatus, and now we have got as far as regular vaporizers ; but I have not heard of any general demand for hygrometers to indicate when, and to what extent, vaporizers are to be used, and I fear that much is still left to the personal sensations of the medical attendant and the nurse, although it is just as easy to order what shall be the hygrometric state of the sick room, as what shall be its temperature, and I think it probable that in many affections of the respiratory organs, the former is of more consequence than the latter.

There is another matter in which hygrometry ought to come home to many, especially at a period when people seem so prone to forsake old and comfortable houses for new and showy ones. Almost before a house is finished, and long before the water necessarily used in its construction has had time to dry out, people rush in to reside, and then there are rumours of colds, rheumatics, &c., as if anything else could be expected in such a climate as that of the

British Isles. I am not going to show how the hygrometer would enable people to adopt this course with impunity, but there are many ways in which it would teach them what to do, and what not to do.

* * * * *

(To be Continued.)

SUPPLEMENTARY TABLE OF RAINFALL IN OCT., 1879.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	·61	XI.	Port Madoc	3·00
„	Littlehampton	1·23	„	Douglas	1·40
„	Dorking, Abinger	·85	XII.	Carsphairn	2·41
„	Hastings, Manor House	1·11	„	Melrose, Abbey Gate ...	1·89
„	Hailsham	·88	XIV.	Douglas Cas., Newmains ..	1·86
„	I. of W., St. Lawrence. ..	1·11	XV.	Islay, Gruinart School..	2·88
„	Strathfield Turgiss	·77	XVI.	St. Andrew's, Cambo ...	...
III.	Great Missenden	·96	„	Aberfeldy H.R.S.	1·55
„	Winslow, Addington ...	·76	XVII.	Tomintoul	2·08
„	Oxford, Magdalen Col... ..	·94	„	Keith H.R.S.	1·45
„	Northampton	·46	„	Forres H.R.S.	·91
„	Cambridge, Merton Vil. ..	·69	XVIII.	Strome Ferry H.R.S....	4·14
IV.	Harlow, Sheering	·85	„	Lochbroom	3·84
„	Diss	·80	„	Auchnasheen H.R.S. ...	...
„	Swaffham	1·15	„	Tain, Springfield	1·41
„	Hindringham	1·85	„	Loch Shiel, Glenfinnan..	7·93
V.	Salisbury, Alderbury ...	·72	„	Dalwhinnie H.R.S. ....	...
„	Calne, Compton Bassett ..	1·11	XIX.	Lairg H.R.S.	2·03
„	Beaminster Vicarage ...	2·19	„	Altnabreac H.R.S.	·60
„	Dartmoor Prison .....	...	„	Watten H.R.S.	2·51
„	Langtree Wick	1·84	XX.	Fermoy, Glenville	1·02
„	Lynmouth, Glenthorne. ..	2·55	„	Tralee, Castlemorris ...	2·01
„	St. Austell, Cosgarne ...	2·04	„	Cahir, Tubrid	1·02
„	Taunton	1·16	„	Tipperary, Henry St....	1·48
VI.	Bristol, Ashleydown ...	1·63	„	Newcastle West	1·45
„	Wem, Sansaw Hall	1·29	„	Kilrush	1·99
„	Cheadle, The Heath Ho. ..	1·27	„	Corofin	2·64
„	Bickenhill Vicarage	·87	XXI.	Kilkenny, Butler House ..	·91
VII.	Melton Mowbray	·75	„	Carlow, Browne's Hill..	·84
„	Horncastle, Bucknall ...	1·27	„	Kilsallaghan	1·43
VIII.	Walton-on-the-Hill	1·13	„	Navan, Balrath	·99
„	Broughton-in-Furness ..	3·95	„	Athlone, Twyford	1·90
IX.	Wakefield, Stanley Vic. ..	·86	„	Mullingar, Belvedere ...	1·41
„	Ripon, Mickley	1·04	XXII.	Ballinasloe	1·47
X.	Gainford	·61	„	Clifden, Kylemore	5·61
„	Haltwhistle, Unthank..	1·77	„	Crossmolina, Enniscoe..	2·88
„	Shap, Copy Hill	1·85	„	Carrick-on-Shannon ...	1·94
XI.	Llanfrehfa Grange	1·12	„	Dowra	3·10
„	Llandovery	2·84	XXIII.	Rockcorry	2·11
„	Solva	1·75	„	Warrenpoint	1·47
„	Castle Malgwyn	1·43	„	Newtownards	1·10
„	Rhayader, Nantgwillt..	2·80	„	Larne, Carnlough	1·77
„	Carno, Tybittle	2·36	„	Bushmills	1·44
„	Corwen, Rhug	1·69	„	Buncrana, Rockfort ...	2·49

OCTOBER, 1879.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ·01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.		In shade.	On grass.		
				Dpth	Date.			Deg.	Date.			Deg.	Date.
I.	Camden Square	·80	— 1·70	·33	19	9	67·4	4	33·4	26	0	4	
II.	Maidstone (Hunton Court)...	·40	— 2·59	·12	24	11	...	...	...	...	...	...
III.	Selborne (The Wakes).....	·98	— 3·23	·15	19	13	63·0	6	28·0	26	2	5	
IV.	Hitchen	·61	— 1·94	·24	24	12	60·0	1	29·0	15	2	...	
V.	Banbury	·68	— 1·75	·12	19	13	63·5	4	31·5	16	1	...	
VI.	Bury St. Edmunds (Culford).	1·11	— 1·60	·32	19	11	65·0	6	29·0	25	4	9	
VII.	Norwich (Cossey).....	1·37	— ·97	·30	2	18	65·0	5	32·0	26	1	2	
VIII.	Bridport	1·36	— 2·67	·59	25	8	...	...	...	...	...	...
IX.	Barnstaple.....	2·47	— 1·65	·74	18	13	70·0	8	32·0	16	1	...	
X.	Bodmin	2·69	— 2·63	·82	25	15	59·0	7	33·0	16	0	1	
XI.	Cirencester	·88	— 2·61	·18	24	9	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	1·42	— ·82	·36	24	12	61·0	1	27·0	16	3	4	
XIII.	Tenbury (Orleton)	1·07	— 2·16	·21	24	12	65·0	4	27·3	16	2	3	
XIV.	Leicester (Town Museum) ...	·91	...	·30	2	15	64·0	6	33·0	16	0	10	
XV.	Boston	·71	— 1·41	·18	1	11	65·0	6	33·0	16	0	...	
XVI.	Grimsby (Killingholme)	·97	...	·24	1	13	60·0	1, 24	33·0	26	0	...	
XVII.	Mansfield	·98	...	·19	14	13	62·9	1	28·7	26	1	...	
XVIII.	Manchester (Ardwick).....	2·67	— ·86	·58	20	15	59·0	1*	31·0	16	1	...	
XIX.	York	·82	— 1·70	·31	14	16	66·0	5, 6	29·5	26	2	6	
XX.	Skipton (Arncliffe)	4·31	— 2·35	1·71	3	17	66·0	5	29·0	25	6	...	
XXI.	North Shields	·69	— 2·59	·30	14	17	59·2	23	31·4	26	2	...	
XXII.	Borrowdale (Seathwaite).....	8·03	— 8·29	3·51	3	15	...	...	...	...	...	...
XXIII.	Cardiff	1·51	...	·35	19	12	63·5	6	30·4	16	1	...	
XXIV.	Haverfordwest	2·27	— 2·92	·60	25	9	63·0	6	37·0	25	0	...	
XXV.	Lampeter (St. David's Coll.) ..	...	...	...	...	...	...	...	...	...	...	...
XXVI.	Llandudno.....	1·63	— 2·33	·33	24	11	61·3	6	48·0	15	0	...	
XXVII.	Cargen	1·73	— 3·75	·42	22	11	63·4	5	28·8	15	3	...	
XXVIII.	Hawick (Silverbut Hall).....	1·06	...	·31	19	10	...	...	...	...	...	...
XXIX.	Annanhill	2·26	...	·89	23	14	60·4	6	25·0	15	4	8	
XXX.	Kilmory	3·67	...	1·02	18	18	...	...	26·0	15	5	...
XXXI.	Mull (Quinish).....	4·06	...	·66	18	19	...	...	...	...	...	...
XXXII.	Loch Leven	1·40	— 3·58	·30	19†	8	...	...	...	...	...	...
XXXIII.	Loch Long (Arddaroch)	4·86	...	...	...	...	...	...	...	...	...	...
XXXIV.	Arbroath	·70	— 2·99	·19	18	7	62·0	10	32·0	26, 28	2	...	
XXXV.	Braemar	1·27	— 1·48	·24	19	12	68·5	7	21·5	27	13	22	
XXXVI.	Aberdeen	1·20	...	·43	18	18	61·2	10	30·1	27	3	13	
XXXVII.	Portree	5·17	— 5·61	1·18	18	20	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	1·23	— 1·43	...	...	...	61·6	6	28·5	27	2	15
XXXIX.	Dunrobin	2·15	— 1·08	·34	13	17	60·5	8	30·0	28	2	...	
XL.	Sandwick	3·40	— 1·52	·57	18	23	54·9	5	43·4	17	0	4	
XLI.	Caheriveen Darrynane Abbey	2·07	...	·30	18	15	...	...	...	...	...	...
XLII.	Cork .....	...	...	...	...	...	...	...	...	...	...	...
XLIII.	Waterford .....	...	...	...	...	...	...	...	...	...	...	...
XLIV.	Killaloe	2·35	— 2·67	·71	18	13	69·0	5	29·0	26	3	...	
XLV.	Portarlington	1·43	— 3·71	·43	18	23	63·0	3	31·0	25	1	...	
XLVI.	Monkstown, Dublin	1·11	— 2·81	·40	25	13	...	...	...	...	...	...
XLVII.	Galway	2·30	...	·59	18	15	65·0	7	33·0	25, 26	0	...	
XLVIII.	Waringstown	1·32	...	·28	19	14	64·0	5	32·0	28	1	3	
XLIX.	Edenfel (Omagh)	2·10	...	·57	19	20	62·0	7	28·0	25	2	...	
L.	Ballinfull .....	...	...	...	...	...	...	...	...	...	...	...

* And 5, 6. † And 24.

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

METEOROLOGICAL NOTES ON OCTOBER.

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

ENGLAND.

SELBORNE.—North-east wind prevailed during the dry part of the month, and, consequently, the farmers have had a most promising seed time.

HITCHEN.—A very cold, dry, dull, and sunless month. Harvest still not completed. Mean temp. considerably below the average of 30 years.

CULFORD.—Mean temp. $48^{\circ}3$; not below the average. Polar winds prevailed during ten days. The weather, during the early part of the month, was very favourable. Swallows were last seen on the 16th. H on 15th.

BODMIN.—Mean temp. of the month $54^{\circ}1$.

CIRENCESTER.—A dry month. E. and N.E. winds prevalent towards the end.

SHIFNAL.—Harvest was not completed till the middle of the month. Grain not much injured, but yield sadly deficient. Fog or mist daily, from 5th to 14th, with high bar. Damsons ripe at last, and an immense crop; apples almost a failure; pears abundant, but many spoilt by cracking. A peacock butterfly at last seen on 4th, but not one red admiral seen this summer.

ORLETON.—The amount of rainfall was smaller than in any month of October since 1842. The weather was generally cloudy, damp, and foggy, with very little sunlight, but yet it was favourable for securing the late harvest. The mean temp. was about $0^{\circ}\frac{1}{4}$ below the average, but there were only three frosty mornings. Distant T on 24th.

BOSTON.—Mean temp. of the month 2° above the average. A great deal of foggy, dull weather. Harvest for white corn finished about the middle of the month, but beans not all carried at the end. Slight fall of S on 15th.

GRIMSBY.—A fine, dry month for gathering the harvest, but both the quantity and quality of the grain were sadly deficient. Short crop of apples and pears. Turnips very small on the clay land.

MANCHESTER.—The early part of the month was wet, followed by a period of dry weather; then, about the middle of the month, it was wet, and rather stormy. Dry weather set in again on 26th, with fogs in the mornings and nights.

YORK.—Though a month of little rainfall, it was not very dry, owing to the mists and drizzle; more sunshine, however, than in previous months. Fine parhelia, at 3 p.m., on 20th.

NORTH SHIELDS.—S and H on 14th and 15th.

WALES.

HAVERFORDWEST.—Windy and stormy for the first four days, after which a period of calm, fine, bright weather set in, but with fogs of the densest and wettest description at night; wind easterly. From the 19th to the 25th, broken weather, with considerable rainfall; from thence to the end fine, serene, cool weather, mostly cloudy. High bar. throughout. The finest and driest October for many years, and certainly the finest month of the present year. Late harvest well saved.

LLANDUDNO.—A dry month. Polar winds prevailed on 20 days, and hence an unusual amount of haze and fog. Mean temp. about $1^{\circ}5$ below average.

SCOTLAND.

CARGEN.—Mean temp. of month $48^{\circ}2$; $0^{\circ}5$ below the average.

HAWICK.—A very fine, mild October, which enabled the farmers to harvest their crops in good order. Green peas were gathered daily up to the 25th.

QUINISH.—A fine month on the whole, with a very unusual amount of calm

and fog. Harvest completed on the 16th. Slight hoar frost from 25th to 29th. Wind from W. to N.W. the whole month.

ARBROATH.—The rainfall is the smallest amount registered in October for 37 years; in October, 1844, the fall was 1·10 in.

BRAEMAR.—As fine a harvest month as could be desired. Crops all secured.

ABERDEEN.—A fine, dry month, though, at times, cold. Mean temp. $46^{\circ}0$; $0^{\circ}5$ below the average of 22 years. Rainfall 1·99 in. below mean of the same period. H on 14th, 15th, and 20th.

PORTREE.—Crops not secured here as yet, and no potatoes lifted. Grass still abundant on the hill pastures.

CULLODEN.—Weather, during the month, very fine. Crops gathered in good condition; bulk above average, but yield not promising. Dahlias and other tender plants in full flower, till cut down by the frost in the last week of the month.

SANDWICK.—October is generally our wettest month, and this October is no exception to the rule, but though the rainfall has been more than in any previous month of this year, it is 1·32 in. less than the mean of 38 years; there were, however, a great number of wet days. The weather was such as to allow the grain crops to be taken in, but some potatoes are still in the ground. There was strong wind of 45 miles an hour on 1st, and of 40 miles on 3rd, 4th, and 13th, but no storm. Large lunar halos on 27th and 29th.

IRELAND.

DARRYNANE ABBEY.—A fine month, with northerly and easterly winds, and very calm sea. The driest October for ten years.

KILLALOE.—Generally overcast, and little sunshine, but very good and useful weather for finishing up harvest work.

MONKSTOWN.—The driest October since 1869; the only rainfall of any account being on the night of the 25th, accompanied by T and H. The bar. was unusually high from the 7th to 13th, during all which time dense fog prevailed. Frost occurred, for the first time this season, on the morning of the 15th.

WARINGTOWN.—On the whole a very fine month, the last week in particular being most opportune, enabling the great bulk of the grain crops in this district to be safely stacked.

OMAGH.—The finest and mildest month of the year. A heavy, though late, cereal harvest well saved.

TWO QUERIES RESPECTING LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—In your September issue, in a report from Cambridge on the TSS of August 2-3, I see it stated that 120 flashes of L per minute were observed (p. 126). In other reports the L, both sheet and forked, is described (p. 126) as incessant, and (p. 128) 33 flashes per minute are recorded.

Am I right in assuming that the so-called sheet L is merely the reflection of forked L; and, if so, may not one flash of the latter produce many reflections from cloud to cloud, so as to appear to light up the sky in different parts by a series of almost continuous reflected flashes? May I also ask whether any explanation has been given of the variety of colour of L?—Yours very truly,

H. GEORGE FORDHAM.

Odsey Grange, Royston, 21st Sept. 1879.