INSTRUMENTS FOR METEOROLOGICAL OBSERVATIONS.

THAT the mortality of particular diseases is governed by a law as unerring as that which is discovered in the general mass of lives is indisputable, although it has not hitherto been developed. The immense advantage both scientifically and socially that would result from the elucidation of such a law is incalculable. Hitherto the imperfection of our statistics has prevented any satisfactory deductions being made; but the aggregation of the Medical Reports made to the Registrar-General, and the fresh aid now about to be brought to bear upon the question by the Officers of Health, will afford a sure foundation for an inquiry which must ultimately lead to the surest and best results.

In the investigation of the law which governs the mortality among persons affected with diseases, the medical profession usually take into consideration peculiar circumstances, such as the various stages, age, sex, occupation, &c.; the influence particularly of seasons, temperature, humidity, the prevailing winds, and other incidental conditions, too numerous to treat with justice in a limited space.

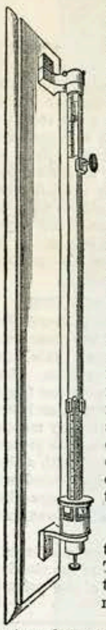
Meteorology, or a knowledge of the weather, involves a full acquaintance with the nature and composition of the atmosphere, with the laws of gaseous and vaporous elasticity, with the conditions determining the production of fogs, dew, snow, and hail; also with the laws of atmospheric, optical, and electrical phenomena. It is the province of Meteorology to study the phenomena of aerolites and the relations which subsist between atmospheric conditions and the development of organic species.

BAROMETER.

With all inquiries connected with Meteorology the Barometer is intimately connected. The atmosphere, influenced by a multitude of causes, is ever varying in density, temperature, humidity, &c. The barometer is employed to determine those incessant fluctuations due to the varying density or pressure of the air. Connected with these inquiries it has rendered very essential service to science. It has determined that the mean pressure of the atmosphere at the level of the sea is everywhere the same, and that as we ascend the pressure becomes less and less. Approximate laws have been determined connecting the pressure of the higher with that of the lower strata of the air, and these have been applied to many important points, relating to physical geography for instance, in making known to us the varied irregularities of the earth's surface, determining the elevation of the sources of rivers, the sites of ancient cities, the height of the highest mountain, &c. It is in daily use in astronomical observatories in determining the amount of atmospheric refraction; on board of ship in indicating the approach of storms; and in storms, connected with the changing direction of the wind, points out the way to sail out of them. In the torrid zone the daily oscillations of the readings of the barometer are found to be so uniform that the hour of the day may almost be known from their variations; even in the temperate zones, where the constant variations from heat to cold, one direction of the wind to another, fine weather to bad, &c., seem to impress uncertainty over all, yet, from a long series of observations carefully made with good instruments, analogous changes are shown.

Thus the barometer holds an intimate connection with the pressure of the air and its distribution over the varied surface of the earth. Its value, however, as a scientific instrument depends on its goodness. From its tube all atmospheric air and moisture must be excluded; the mercury must be boiled within its tube and be pure; the diameter of the tube should be such that the correction for capillary action should be small; and in such a tube the mercury moves with greater freedom, and the variations of reading follow with more promptness than in one of small diameter. Its readings should be compared with those of a standard barometer to determine its index-error, and in use corrections should be applied for the influence of capillary action, and for index-error.

The barometer in general use, and that recommended by the Council of the British Meteorological Society, is on M. Fortin's principle. (See the annexed diagram.) It consists of a tube, three-tenths of an inch in its inner diameter, filled with mercury, the specific gravity of which is 13·5, and has been boiled within the tube throughout its entire length. The open end of the tube is immersed in a cistern of mercury, and the whole inclosed in a glass cylinder or outer tube. A piece of ivory or steel is affixed to the upper part of the cistern, pointing downwards; the image of this is reflected from the surface of the mercury in the cistern, which is raised or lowered till the ivory point and its reflected image are just in contact. This ivory point forms one end of the scale. The upper part of the brass tube is graduated to inches and tenths of inches, reckoning from the ivory point in the cistern, and constitutes the other end of the scale. The whole is attached to a slab of mahogany, which may be secured at will against a wall or wooden frame. This barometer has been well received by a very large number of meteorological observers in England; and has been adopted by the East India Company, and by the Spanish and many other Governments.



We will now suppose the observer in possession of his barometer as received from the optician. He is desirous to ascertain that it is in good working order; he should therefore first determine whether the space above the mercury is free from air, which is done by slightly inclining the instrument from its vertical position, when, if the mercury, in striking against the upper end of the tube, elicit a sharp tap, the perfect condition of the vacuum is fully established. If the tap be dull, or not heard at all, the amount of air above the mercury is considerable, and must be driven into the cistern by inverting the instrument, and gently tapping it with the hand. If the confined air cannot be thus expelled, the instrument is useless.

Having satisfactorily determined that there is no air within the tube, it is necessary to fix the barometer in a suitable position. This should be chosen commanding a good light, but not exposed to sunshine; and the tube adjusted to a vertical position by means of a plumb-line.

In observing, the eye should be placed on the exact level of the top of the mercurial column, and the reading taken by means of a scale or vernier, movable by means of a tangent screw; the scale is raised or lowered till its edge just touches the convex surface of the mercury in the tube. The observation by this means can be readily made to the two-thousandth of an inch with precision. Throughout the world the reading of the barometer has two daily tides, and reads highest from 9h to 10h A.M. and P.M.; and lowest at 3h A.M. and 3h P.M. But the instrument is so sensibly affected by the weather that these changes are masked and concealed by the larger irregularities, and can only be determined after a series of observations.

Countries near the sea are more especially subjected to winds of diurnal periodicity, known as land and sea breezes. About eight or nine A.M. an aerial current begins to flow from the sea towards the land, and persists until about three P.M., when a current in the reverse direction, or from the land to the sea, takes place, and continues throughout the night until sunrise the next morning, when it ceases, and a calm ensues until the completion of a period of twenty-four hours from the occurrence of the preceding land breeze. These currents in reverse directions can be easily accounted for when we consider the heating agency of the sun. Necessarily land becomes hotter than water under an equal power of luminous rays, whence it follows that the surface of the ground, becoming heated after sunrise, determines the ascent of an atmospheric current vertically; thence proceeding oceanward, the same current returns from the sea to the land. No sooner does the sun set than this current is reversed. Hence the necessity arises for morning and evening observations in meteorology.

THERMOMETER.

The Thermometer is an instrument for determining heat or temperature, and is familiar to every one. The principle of its construction is founded upon the expansion of bodies under the influence of heat; and mercury, as expanding more uniformly under equal increments of heat within the range of atmospheric temperature, is usually employed in their construction. The conditions necessary to a good thermometer are, that the bore of the tube be of equal size throughout, the zero and 32°, or freezing point, accurately determined, and the graduations performed with exactitude. For the purposes of meteorological observation it is necessary that they be compared with a standard thermometer, that their index-errors may be ascertained and applied at the time of reading.

The thermometer in use in England is that of Fahrenheit, the scale of which is determined by dividing the space between 32° (freezing point of water) and 212° (boiling point of water) into 180 parts, called degrees. By continuing these divisions both above and below these points the scale may be continued at pleasure for the requirements of extreme temperatures.

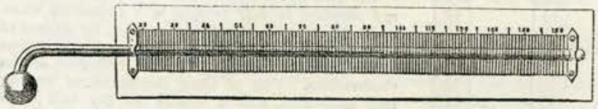
REGISTERING OR MAXIMUM AND MINIMUM THERMOMETERS

are furnished with a means of determining the extremes of temperature during the day and night. The

MAXIMUM THERMOMETER

is used, as its name implies, for determining the maximum or highest temperature of the air. That of Rutherford's construction until lately has been generally employed, and differs from the ordinary thermometer chiefly in the introduction of a steel index within the tube, which, being adjusted to the end of the mercurial column, is made to slide easily along as the increasing temperature of the air causes an expansion of the mercury withinside. It follows, then, that the index so propelled remains at the highest point of expansion, and thus records the maximum temperature of the day. The mercury being withdrawn from contact as the temperature declines, the index remains, and that end nearest the bulb being read upon the divisions of the scale gives the required maximum temperature. In use the instrument is suspended nearly horizontal, its bulb is a little raised, and one end movable, so as to be readily detached for the purpose of setting, which is done by quickly inclining the instrument with its bulb downwards, so as to allow the index to pass at once from its last reading to the end of the mercurial column; having done this, the thermometer is again replaced, and the instrument is in order for the next observation.

In practice this instrument is subject to frequent derangement; the index becomes at times immovable, arising from corrosion in the tube, or becoming immersed in the mercury. A new form of instrument, which obviates these inconveniences, has been invented by Messrs. Negretti and Zambra, opticians, Hatton-garden, which dispenses with the necessity for an index. A small piece of

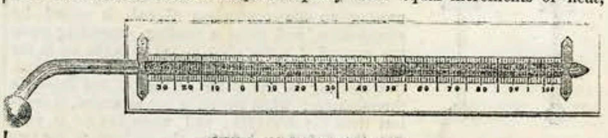


NEGRETTI AND ZAMBRA'S PATENT MAXIMUM THERMOMETER.

glass is inserted within the tube, past which the mercury is forced in its expansion, but cannot repass in its contraction. The end of the column, therefore, gives the required reading, as the contraction of the mercury takes place within the space below the bend of the tube. This instrument is easily set, and is scarcely liable to derangement. It is recommended by the Council of the Meterological Society to all observers, and has been found to answer well.

MINIMUM THERMOMETER.

The Minimum Thermometer, for recording the lowest temperature of the air is filled with alcohol, within which floats an index half an inch in length. The alcohol, however, does not expand equally with equal increments of heat,

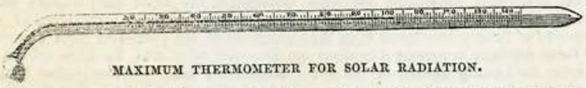


MINIMUM THERMOMETER.

and the tubes of instruments so filled are for this reason not of even bore. The instrument is not fitted for delicate thermometric purposes; and a mercurial minimum thermometer is a desideratum. The index being set to the extreme end of the spirit column, on the contraction of the fluid under a decrease of temperature, it is carried with it in its descent towards the bulb; but, unable to return, as the alcohol expands under an increase of temperature, it remains fixed at its lowest point, and thus records the minimum temperature as required; the observer taking care to read on the scale that end of the index which is the farthest removed from the bulb.

MAXIMUM THERMOMETER FOR SOLAR RADIATIONS.

A Maximum Thermometer for Solar Radiation is a simple and extremely delicate mercurial glass thermometer, with blackened bulb, and graduated on its own stem; it is furnished with a steel index similar to the maximum

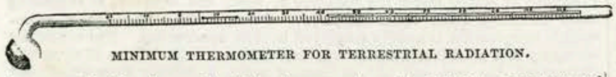


MAXIMUM THERMOMETER FOR SOLAR RADIATION.

thermometer of Rutherford's construction. Negretti and Zambra have made some beautiful thermometers for solar radiation on the principle we have already described. They have been found to answer well. This instrument should be so placed that its bulb is fully exposed to the sun, but at the same time guarded from any strong draughts or currents of air.

MINIMUM THERMOMETER FOR TERRESTRIAL RADIATION

is for the determination of the lowest temperature of the earth, on which it should be placed, resting on grass, its bulb fully exposed to the sky. This



MINIMUM THERMOMETER FOR TERRESTRIAL RADIATION.

instrument is likewise graduated on its own stem; its bulb is transparent, and it is filled with alcohol.

HYGROMETER.—RAIN-GAUGE.

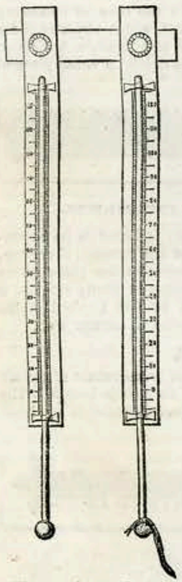
A Rain-Gauge for measuring correctly the amount of rain-fall for his particular locality is required by the meteorologist. One of the most simple, and at the same time most effective, contrivances for this purpose is a cylinder, about thirteen inches in height and eight inches in diameter, made of zinc, copper, or any other durable metal. The top of the cylinder is closely fitted with a funnel so finished around the edge as to preclude the possibility of loss by evaporation. The receiving-surface of the funnel is turned in a lathe, measured with care, its area computed, and a weight of water calculated corresponding to a fall of rain of half an inch in depth.

The measuring-vessel is a glass cylinder of small diameter, into which a weight of water is poured corresponding to the fall of half an inch of rain, and graduated to tenths of inches, and one of a hundredth of an inch is easily read. The instrument should be placed so as to command an open space for some distance around, and sunk below the surface of the soil, so that the receiving-surface is about four or five inches above it.

The fall of rain as collected in a gauge placed at some elevation above the surface is less in amount than that collected near the surface of the earth. It is, therefore, necessary that the observer record the circumstances of its position, whether sunk in the earth or raised a certain number of feet above the surface of the ground.

DRY AND WET-BULB THERMOMETER.

We have now to speak of an instrument scarcely second in importance to the barometer, viz:— the Dry and Wet Bulb Thermometer. This very simple and beautiful adaptation for determining the hygrometrical conditions of the atmosphere is worthy every attention of the meteorologist, who will find its results of the utmost importance to his investigations.



The instrument, as made by Negretti and Zambra, consists of two extremely delicate and similar thermometers, suspended side by side, and braced together by a cross piece of metal, upon which they are adjusted by means of screws and steadying-pins.

The two thermometers should be uniform in size, and identical in their reading with a standard when under the same circumstances; or if not, the amount of error should be ascertained and applied as a correction at the time of reading, or in the reduction of the observations. One of these thermometers has its bulb uncovered, and is termed the dry bulb; the other is enveloped with fine muslin, from which a piece of darning cotton or lamp-wick proceeds to a glass beaker, or cup of water placed contiguous to the bulb. (See the annexed diagram.)

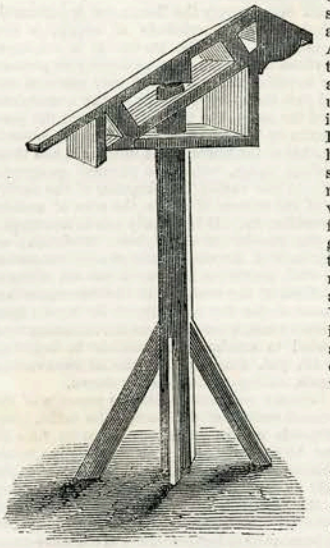
The instrument thus fitted is ready for use, it should be placed out of doors in the shade, and suspended with the bulbs about four feet from the ground. Care should be taken that the water-vessel be at all times supplied with water, and the conducting thread and muslin occasionally renewed.

The readings of the instrument should be taken at definite times, and signify as follows:—

That of the wet bulb, as moistened by the water passing up the conducting thread, is cooled by evaporation, and gives a reading depending upon the amount of water then mixed with the air in the invisible shape of vapour. When the air is saturated, this reading is the same as that of the dry-bulb thermometer; when the air is not saturated, it reads less than the dry-bulb; and when the air is very dry, the difference between the readings of the two instruments is great.

From the joint reading of the two thermometers, the actual amount of water then present in the air, as well as the degree of humidity, can be readily determined; and, when further combined with the reading of the barometer, the actual weight of any mass of air, in its then state of temperature, pressure and humidity, becomes known.

This instrument is valuable in many ways, besides aiding in meteorological investigation. In the present pursuit after a correct knowledge of the immediate cause of death, a knowledge of the humidity of the atmosphere is highly desirable. In the sick-chamber its use is at once evident; if the air of the apartment be too dry, as is often the case in frosty weather, the reading of the thermometers will be widely different; if the air be moist, the difference between them will be but small; and if the air be saturated, the readings will be identical. As life, in many cases, depends on the temperature, state of dryness, or humidity of the air, it is desirable that the medical attendant should possess a means of ascertaining the condition of the atmosphere which his patient is compelled to breathe, that he may point out the temperature and the degree of dryness most beneficial. In regulating the hygrometrical condition of the air in conservatories, &c., it may be made of essential service,—the temperature of the air being regulated by the dry-bulb, and the degree of humidity by the wet-bulb. In places where stoves are used its value is likewise great; and the whole of the inconvenience experienced by those who sit in rooms so heated would be avoided by having a surface of water exposed of sufficient extent to cause a wet-bulb thermometer to read 10° below that of the dry. In warehouses and manufactories—to the merchant whose dealings are in filamentous substances, such as wool, flax, &c.—the instrument may render great assistance; the weight of all such substances varying considerably with their exposure to an atmosphere more or less dry; also in malting-houses, and in the laboratory of the chemist. The same might be said in regulating the temperature and humidity of public hospitals.* At a few of these valuable institutions hygrometrical observations are carefully recorded, but still not upon that extensive scale that the importance of the subject demands. Every dormitory attached to our hospitals, prisons, workhouses, schools, &c.—in fact, wherever a number of persons congregate, whether these apartments are used for sleeping or working in—hygrometrical observations should be taken, in order that such places may be kept in the most favourable condition for sustaining life. We have not the least doubt that, if these suggestions are acted upon, a very material decrease in some diseases (pulmonary especially) will result therefrom.



GLAISHER'S STAND FOR THERMOMETERS.

It is desirable that the thermometers should be suspended so that their bulbs be freely exposed to the air on all sides, at the distance of four feet above the soil, and removed to some distance from houses or water,* or from any object which might reflect heat to them. To attain these conditions it is necessary to have a stand to carry the instruments. Annexed is the form of a suitable revolving-stand; the instruments are to be placed on its face, and the back turned towards the sun.

OZONOMETER.

The peculiar gas Ozone is generated from the oxygen of the air when it is surcharged with electricity. Ozone possesses a powerful odour, while ordinary oxygen gas does not: the former, when in excess, is a violent poison, the latter an indispensable supporter of animal life. The presence of ozone in excess exerts a very sensible influence in many ways upon health, and in its chemical activity in changing the character of various substances used in domestic life. The inhalation of an irritating gas cannot but produce injurious effects on organs so delicate as the lungs; and perhaps many of the now anomalous and inexplicable effects of change of air to patients suffering from chest diseases may hereafter receive their solution, in a more intimate acquaintance with the laws of ozone. The eminent chemist Schonbein invented a delicate test paper, imbued with a mixture of iodide of potash and starch, by means of which the medical man can detect the presence of this gas, and estimate the quantity contained in the air.

DIRECTION AND STRENGTH OF THE WIND.—ANEMOMETER.

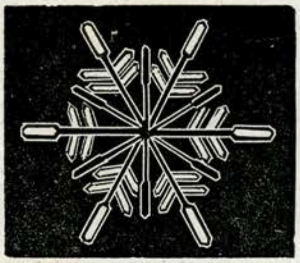
The force and direction of the wind claim the attention of the meteorologist. For this purpose several anemometers have been constructed that have been found to answer well, and to act a considerable time without derangement. It is, however, an expensive instrument, and difficult to adjust in a suitable position. There are few observers in possession of a locality for the placing an anemometer to give a really true indication of the movements of the air. It is, however, an instrument applying to a meteorological observatory, and as such we may mention Osler's anemometer, which itself registers the direction of the wind, its pressure in pounds on the square foot, and the fall of rain. It is furnished with a clock which drives a traversing-board, upon which is fastened a paper ruled with hour lines, upon which pencils, in connection with the vane, pressure-plate, and rain-receiver, register these elements as the clock drives the traversing board from one hour-line to the next.

In the absence of an anemometer, the direction of the wind may be referred to the position of a vane; or, if no good vane is in sight, the course of the clouds or smoke shows the direction, if the position (to the observer) of the points of the compass be known.

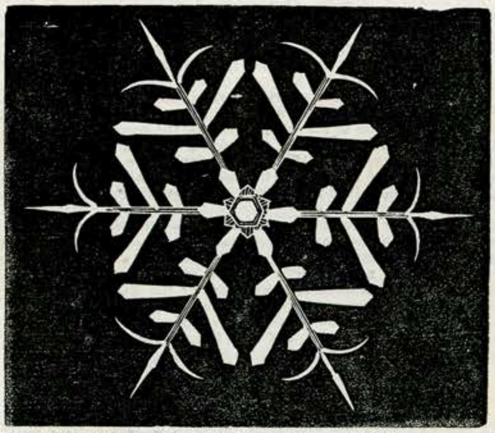
* See "Hygrometrical Tables," by J. Glaisher, Esq., F.R.S., published by Taylor and Francis, Redlion-court, Fleet-street, London. These tables should be in the possession of every meteorologist

SNOW GAUGE.

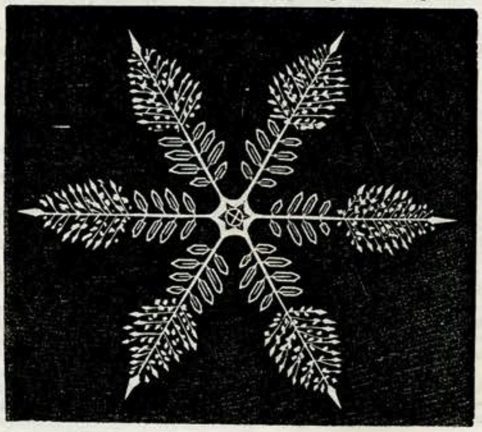
The gauge in general use is one made of a thin metal cylinder, eight inches in diameter, and twelve inches deep, graduated on one side to a quarter of an inch. This cylinder will penetrate through the snow, scarcely disturbing it, and the depth in inches is at once seen. By careful manipulation, if the cylinder is turned round, all the inclosed snow may be lifted from the ground, and removed to a wide-mouthed bottle to melt, and the quantity measured. The *snow-line* is that elevation at which atmospheric moisture is changed into snow. Snow does not usually fall at the time of maximum cold; and after snow has fallen the weather generally increases in severity. When the temperature falls to 32° Fahrenheit, water ceases to be liquid, and becomes ice; the weather is then said to be frosty. Whatever water be contained in the atmosphere at the freezing temperature, is deposited in the solid form of hoar-frost, the particles not being irregular, but bounded by definite mathematical outlines,—frequently giving rise to forms of great beauty, similar, in general contour, to those of well-formed snow-flakes, but far more beautiful; and, like snow-flakes, prove that frozen water is a crystalline body, and that it crystallizes in forms belonging to the rhombohedral system. During the severe winter of 1855 Mr. Glaisher made a collection of drawings of some of the most beautiful forms of snow-flakes seen at various times, some of which we have figured:—



Mr. Glaisher writes:—"My own observations have been made for the most part with the aid of a good Coddington lens, which discloses as much of the crystalline formation of these bodies as is commensurate with my power of representing accurately. I have been much struck with the complicated arrangement of the nuclei, composed as they are of an almost endless combination of simple lines and prisms. These last, I should mention, are raised—some varieties exhibiting an arrangement of numerous facets, which give great solidity to the prism."



"This morning, Feb, 21, 1855, with a temperature of 21 deg., they are falling, sparingly, but are intensely beautiful: they are also minute, and highly crystalline. Up to the present time, 9h. 30m., all that I have observed are made up of prisms of six facets; and many are double, that is, two crystals alike in form are falling, united to an axis at right angles to the plane of each."



Mr. Glaisher gives the following additional general directions for the guidance of the meteorological observer:—"Preserve as much as possible the continuity of the observations. It is desirable not to change the positions of the different instruments, nor even to alter the method of reading and registering. If, from any cause, the continuity of the register should be broken, on no account attempt to fill the blank so caused by estimation. Be punctual to the hours determined upon for observations, and read off the instruments in the same way every day. Before calculating the *means*, examine each column to ascertain that no evident error of entry has been made.

"The thermometers should be protected from rain; and in making a reading the observer should do it quickly, and whilst doing so avoid touching, breathing on, or in any way warming the thermometers by the near approach of the person. Thermometers should be frequently compared with a standard instrument, in order to ascertain whether the freezing-point has remained at the temperature as marked off on the scale.

"It is desirable to note in *Thunderstorms* the direction in which they move, the point in the horizon in which they were first noticed, and that in which they disappeared; the time when thunder was first and last heard; the colour of the lightning; the number of seconds elapsing after a flash before thunder became audible (noted at different periods during the storm's continuance); the commencement and termination of rain; the direction of the wind before, after, and during its continuance; the times when the electrical breeze springs up (this is a peculiar violent breeze noticed in most thunderstorms); whether hail falls; and any other feature that may appear remarkable.

"*Aurora Borealis*—Its position amongst the stars, whether merely a low auroral arch, or accompanied by coruscations. If a brilliant display, whether a cupola or dome is formed a little south of the zenith; and if formed, whether oscillatory among the stars. The hour of its occurrence when seen as a diffused light; if there be floating patches of luminous haze or cloud, &c.

"*Solar and Lunar Haloes*—When visible, the quarter of the heavens where they appeared, and how long they remained visible.

"*Mock-Suns and Complicated Circles of Light*—Their form and position with respect to the sun or moon; whether prismatic.

"*Meteors, or Falling Stars*—Their falling size, shape, colour, path amongst the stars, velocity and duration; whether accompanied by a streak of light, or separate fragments; if large, whether a streak of light remained after the meteor itself had disappeared; and after bursting, whether any noise of explosion be heard, if so, how many seconds after the meteor itself had burst; the time of appearance, &c. These observations should more especially be attended to from the 6th of the 16th of August, and from the 9th to the 14th of November.

"*Gales of Wind*—Their direction and estimated force; when they commenced and terminated; the height of the barometer during its continuance.

"*Snow*—Note when it fell, how deep in inches on the ground, and the form of the snow crystals. *Hail*—The shape of the stones, &c. The times of breaking up of long dry periods and frosts; the termination of rainy periods; the commencement and duration of fogs, wind changes, &c.

"*Solar Eclipses*—During their continuance, and before and after, record the temperature in sun and shade repeatedly. Expose for ten seconds, every five minutes, slips of Talbot's Photographic Sensitive-paper, to ascertain the effect of the diminution of sunlight on this paper.

"*Calendar of Nature.*—Every meteorologist should endeavour, as much as possible, to record the arrival and departure of migratory birds, the dates of trees coming into and losing their leaves, the blooming of plants, the ripening of fruits and seeds, the building of birds' nests, the first appearance of various insects, diseases amongst animals and plants, the appearance of abundance or otherwise of crops of fruit, corn, &c. If such registers were extensively kept and carefully recorded, the effect of the weather upon the animal and vegetable kingdoms would be well seen. It is extremely desirable that every precaution should be taken, in order that, year after year, the same object should be the special one on which the remarks are based, and that one species should not be mistaken for another."

Aerial Phenomena.—In Great Britain, upon an average of ten years, westerly winds exceed the easterly in the proportion of eleven to seven, and the northerly winds exceed the southerly as nineteen to seventeen.

The most permanent rains in this climate come from the southerly regions.

The average quantity of vapour in the atmosphere decreases from below upwards, and from the Equator to the Poles.

The quantity of vapour in the atmosphere in the different seasons of the year (measured on the surface of the earth and near the level of the sea) follows the progress of the mean temperature in an inverse order.

The pressure of the aqueous atmosphere, separated from that of the aerial, generally exhibits directly opposite changes to the latter. Fogs arise whenever the air becomes colder than the water. 1. Fogs will be most frequent in autumn, after the earth has been heated during the summer, the air cooling faster than the earth. 2. Fogs will be greatest after the hottest summer. 3. Fogs show that the air has become suddenly colder, and therefore are a sign of snow. 4. Fogs will be rare in hot climates, where the air is usually very hot. 5. Fogs will be very frequent in the Arctic regions, where the sudden depressions of temperature are enormously below the mean temperature. 6. Fogs will be most frequent over shallow water, which sooner partakes of the temperature of the bottom than deep water. The end of the deep water is known near the banks of Newfoundland by the sudden commencement of the fogs. 7. If the London fogs have increased during late years, it will prove either that the mean temperature has increased, that the variations of temperature have increased, or that the Thames has diminished in depth.

ELECTROMETER.

Atmospheric electricity has been much neglected by meteorologists. The beneficial effects of electricity on the vegetable kingdom are of a character so apparent, that any extended researches upon this branch of Meteorology, calculated to throw additional light upon the subject, is very desirable. There are several instruments used in studying the subject; the most simple is Glaisher's electrometer, which, being portable, should become generally adopted. To be able to announce the approach of a thunderstorm at a time when the sky is free from clouds, and to ascertain its speed so as to tell when it may be expected in any given place, would afford the farmer, the mariner, and many other persons, information of a most valuable character.