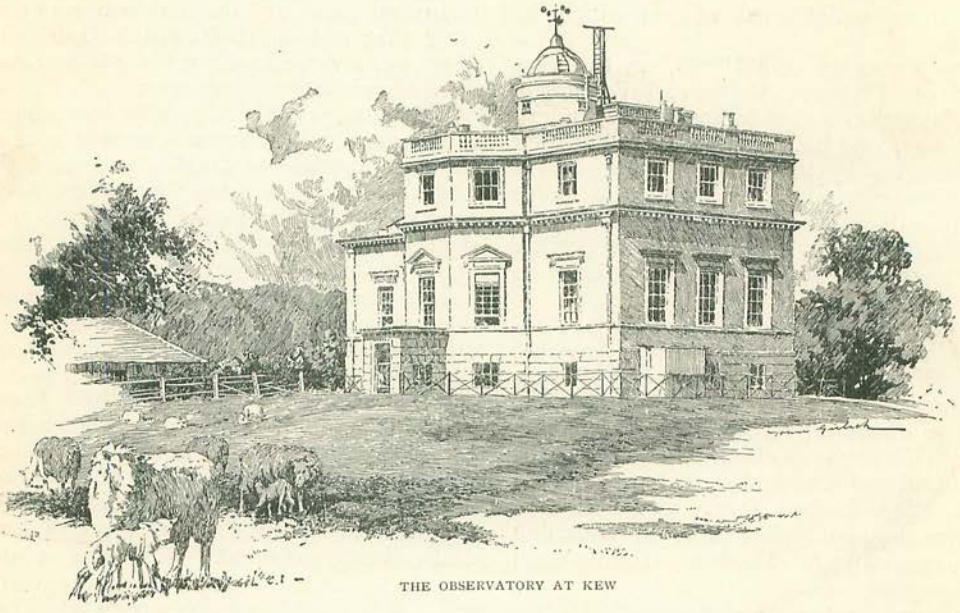
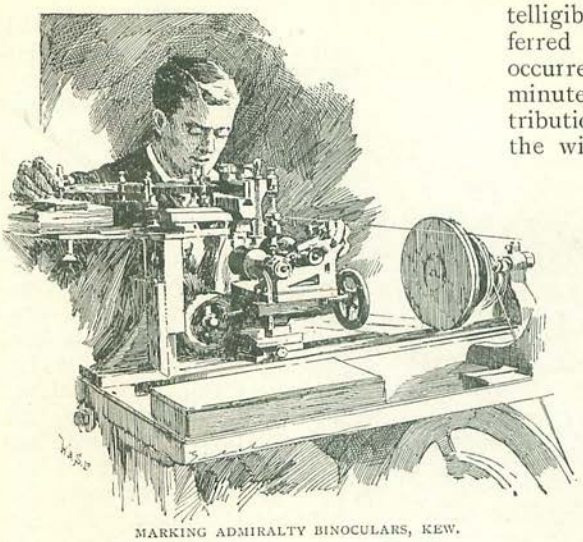
Weather Watchers and their Work.



THE OBSERVATORY AT KEW

TO old and young, to rich and poor, to the invalid and to the most robust, to the worker and to the pleasure-seeker, the weather is a source of perennial interest. It means so much to every one of us: to our spirits, our tempers, our energies. In some way or other ninety-nine out of every hundred individuals are personally concerned in the response which nature will give to the daily query, "Will it rain?" In the stately entrance halls of the houses of the wealthy, and in the humble abode of the peasant, we shall usually find some proof of the ever-present desire to know what is going to happen meteorologically. In the first case, the rise or fall of the barometer is looked to; in the second, the relative positions of the man and woman in the old Dutch weather-gauge, or the dryness or dampness of the seaweed brought home after some recent holiday, afford an indication of the disposition of the Clerk of the Weather. As a rule, one of the first items turned to in the morning newspaper is the report and forecast issued by the Meteorological Office. One can imagine, for instance, how eagerly the unfortunate agriculturist in the dreary summer months of 1891 has sought to know the best or worst likely to befall his crops. Farmers are said to be especially fond of forecasts, and one of their number is credited with the assertion that they are a good thing, because if they promise fine weather, although they turn out to be wrong, they at least keep up one's spirits, and give one hopes of better times.

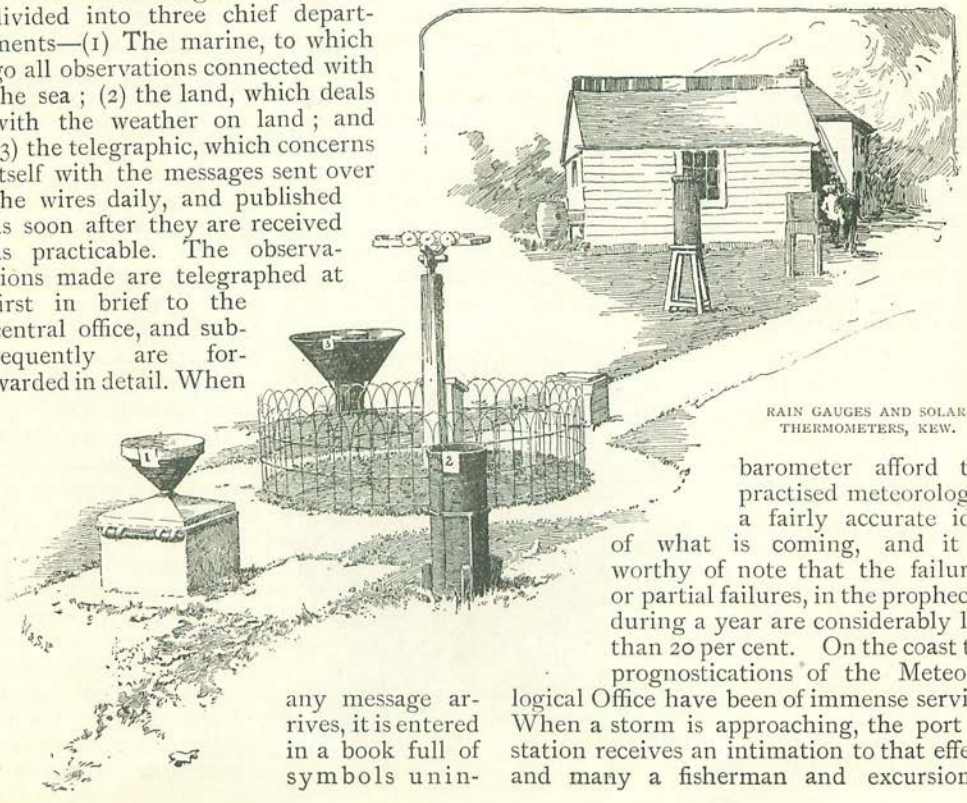
The Clerk of the Weather, as Mr. R. H. Scott, the Chief of the Meteorological Office, is often called, is to be found in Victoria-street, S.W. The Meteorological Office is the centre to which observations taken at some eighty different stations throughout the country come three times daily. In the doorway charts containing the latest observations are posted at 9 a.m., 11 a.m., and 3 p.m., whilst beneath the windows on the first floor the casual passer-by will notice boards which describe the state of the wind and weather at various places on the coasts of Ireland and England. The duty of the office is to secure for the benefit of the public a more or less complete record of the vagaries of nature. Whatever the mood of the great goddess, the meteorologist notes it down. He watches her at peace and at war, and enters up the number of her smiles and the intensity of her



MARKING ADMIRALTY BINOCULARS, KEW.

passion. If she bursts into uncontrollable fury, say at Dublin, or Valentia, or Yarmouth, the information reaches the office, and is despatched broadcast to all whom it may concern. Both calm and storm are registered with extreme care.

The Meteorological Office is divided into three chief departments—(1) The marine, to which go all observations connected with the sea ; (2) the land, which deals with the weather on land ; and (3) the telegraphic, which concerns itself with the messages sent over the wires daily, and published as soon after they are received as practicable. The observations made are telegraphed at first in brief to the central office, and subsequently are forwarded in detail. When any message arrives, it is entered in a book full of symbols unintelligible to the outsider, and is then transferred to a map, all changes which have occurred since the last report being studied minutely. Charts are then prepared for distribution, showing the direction and force of the wind, the barometrical pressure, the temperature, and the atmospheric conditions generally. The comprehensive idea which the Office thus acquires of what Nature is doing over a considerable portion of the earth's surface, enables it to accomplish two useful pieces of work—to forecast the weather for the next twenty-four hours, and, if necessary, to warn particular localities to look out for squalls. Each London newspaper, and many provincial ones, are supplied with the information, whilst the reports are despatched to 400 different people anxious to have the earliest weather intelligence daily. Some people are disposed to laugh at the forecasts made, but in the main they are very trustworthy. It is never possible to be quite sure what will happen at any one spot, but over a district the readings of the barometer afford the practised meteorologist a fairly accurate idea of what is coming, and it is worthy of note that the failures, or partial failures, in the prophecies during a year are considerably less than 20 per cent. On the coast the prognostications of the Meteorological Office have been of immense service. When a storm is approaching, the port or station receives an intimation to that effect, and many a fisherman and excursionist



RAIN GAUGES AND SOLAR THERMOMETERS, KEW.

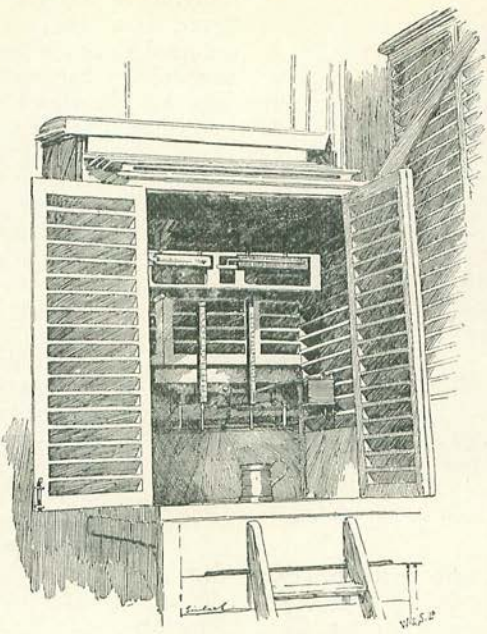
owes his comfort, if not his life, to the friendly storm-cone hoisted to warn him either not to go out or to come in immediately. The belief of some good people in the Meteorological Office is so great that Mr. Scott has frequently received letters asking that certain weather may be arranged for a day on which a flower-show or some other event in which the writers are concerned, takes place. One letter which he preserves came from Southend, and was addressed to—

THE CLERK OF
THE WEATHER,
Meteorological
Society,
Sun-court,
London.

It was dated February 15, 1889, and ran:—

"My dear Clerk,—I must tell you I am very tired of this weather. We had some rain and snow. I supose (*sic*) you know all about it. Mamma told me to write. Please will you send us some fine weather. —(Signed) CONNIE."

The Marine Department of the Office, presided over by Lieutenant Baillie, R.N., is performing the most valuable work of collecting data referring to every current and every wind, and every temperature in every accessible sea. In this work the assistance of ships' captains is enlisted. The Office lends them instruments of the best and most reliable character, comprising one barometer, six thermometers, and four hydrometers. A rough book and a form of meteorological log are presented to the captain, who, on his return, sends the latter to Victoria-street. Some 200 captains are thus taking notes over various seas, and the logs stored up at the Office already number about 6,000. When the logs come in they are very carefully examined, characters are given them — "good," "very good," or whatever it may be—they are then registered, and become part of the permanent records of the Office. The importance of the observations taken by ships' captains cannot be over-estimated, and ready testimony is paid to the value of their services by the experts who deal with the reports. For some time past, for instance, the Office has been engaged in the study of the currents of the seas over the whole globe, and these, together with cyclone tracks, and every other meteorological eccentricity, are all becoming known as a result of the labours of volunteer observers. Charts of currents for every month of the year are now being produced, and all prove of incalculable use to the mariner in charge of precious cargo, and more precious lives. They tell him what the normal conditions should be, and if the conditions are not normal, he knows that extra precautions against mishaps must be taken. On the charts the direction of the currents is shown by myriads of tiny arrows of all lengths, an arrow an inch long indicating a current of a hundred miles in the twenty-four hours.



A THERMOMETER SCREEN.

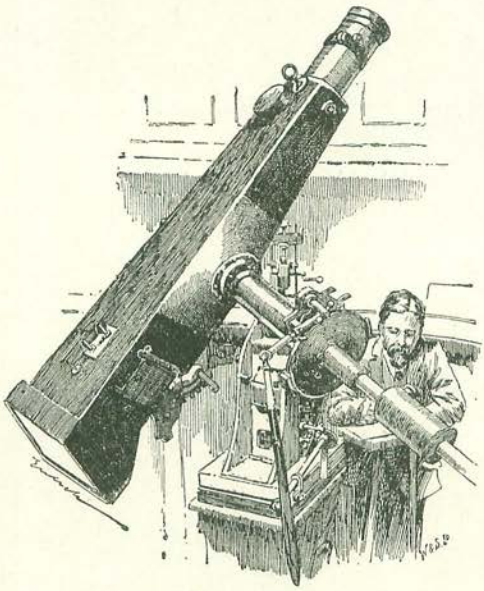
A SUNSHINE RECORDER.

As with the Marine, so with the Land Department. There are any number of volunteer workers

who take observations daily at 9 a.m. and 9 p.m. Throughout the Empire observations are being made by officers of the Royal Engineers and of the Army Medical Department, among them being Sir Charles Warren, whose pictures of the phases of the moon taken at Gibraltar, are religiously preserved. For the convenience of observers of all nations, an international code exists, so that when the observations are entered up they are as intelligible to a Russian or a Frenchman as to an Englishman. The chief work of the Land Department, however, naturally lies within England itself, where it has been very thorough. For years back they can tell one what happened at any particular place near one of their observatories on any particular day. In Victoria-street there is a continuous record of barometrical pressure, of how fast the wind blew, of how much rain fell, and of how much sunshine we enjoyed.

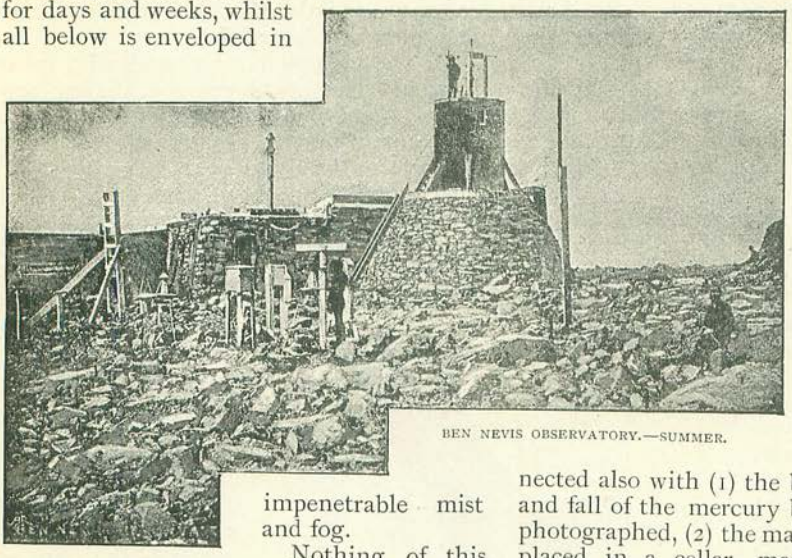
Having now gleaned some idea of the Central Office and its work, we will take a trip to Richmond, and make a hurried inspection of the Kew Observatory. It is convenient to take Kew, because here is to be seen all that is to be seen elsewhere and much more. Kew Observatory does several things besides take notes of the atmosphere. It tests watches, chronometers, telescopes, binoculars, &c., and issues certificates with them. One of our pictures shows a man at work engraving the Kew Observatory monogram on Admiralty binoculars, which have successfully stood the tests applied. Kew Observatory also has a history. It is built on the ruins of a monastery, and is really a Royal Palace, devoted to its present purpose during the Sovereign's pleasure. George III. had a laboratory here, and always took great interest in the observations made from this spot. Before he lost his reason he himself often made observations of the sun passing the meridian, by which the clocks at the Houses of Parliament and the Horse Guards in Whitehall used to be regulated. The present Observatory was erected by his command in order that the transit of Venus in 1769 might be watched.

Of the thousands of people who go to Kew and Richmond every week, few probably know of the existence of the Observatory, and, when they see it for the first time, either from the river or across a park three-quarters of a mile long, are surprised to find that it does not stand on an elevation. Ben Nevis seems to the ordinary mind a much more appropriate spot for an observatory than a flat field by the river side. Ben Nevis, among British observatories, is an exceptionally interesting and suggestive place. The mountain itself is the highest in the British Isles. The Observatory, of which, through the courtesy of Mr. R. T. Omond, the superintendent, we are able to give two excellent pictures, is, it should be said, not under the Meteorological Office, but copies of its observations are sent to London regularly in return for an annual grant. When, a few years ago, it was decided to build the Observatory, a public appeal was made for subscriptions, and the widespread interest taken in meteorology is shown by the fact that the sums sent in ranged from 1d. up to £200. Our illustrations afford some idea of the sort of duty the observer on Ben Nevis has to face. For several months of the year the Observatory is, except for the electric wire, entirely cut off from the outer world, and has to be provisioned against the long siege maintained by the elements. One winter, the road up to the top was for six weeks absolutely impassable. In February, 1884, the weather was so bad that the outside instruments had to be studied by two observers lashed together, whilst storms have been so severe at times that observations have been quite out of the question. At other times, Nature seems anxious to compensate the watchers



SOLAR OBSERVATIONS WITH THE PHOTOHELIOGRAPH.

for these trials, by transferring her demonstrations lower down. The Observatory then enjoys clear sunshine for days and weeks, whilst all below is enveloped in impenetrable mist and fog.



BEN NEVIS OBSERVATORY.—SUMMER.

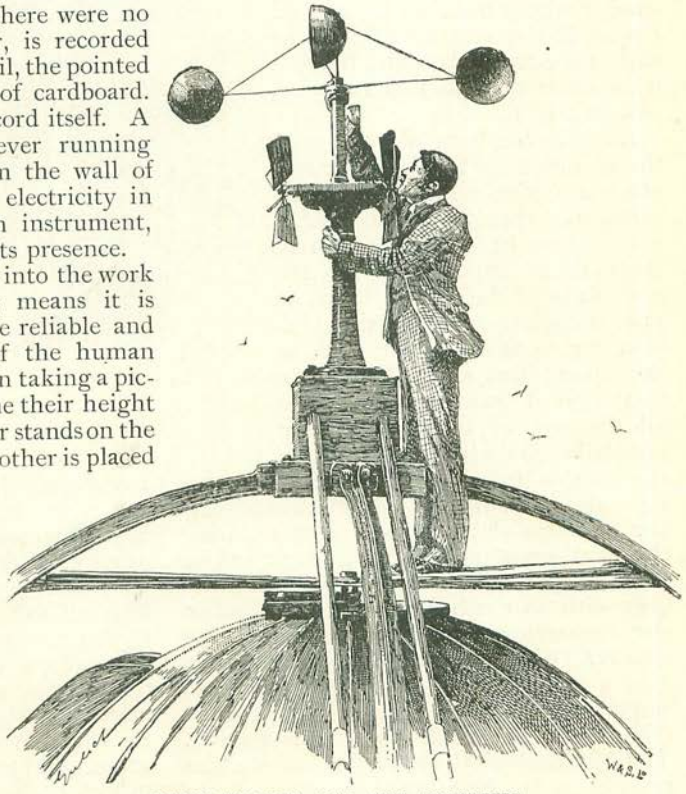
Nothing of this sort, bitter though the weather may be in all parts of the British Isles, is ever seen at the Kew Observatory, to which we are about to pay our hasty visit, under the kindly guidance of Mr. G. M. Whipple, the superintendent. As you approach the Observatory, the first thing you notice and want to know all about, is the anemometer on the top. Four cups at the end of short iron rods are whirling more or less rapidly, according as there is much or little wind. These, you learn, are in connection with an instrument inside the building, which records the rate at which they turn, and consequently the rate at which the wind is travelling. Sometimes Master Boreas takes it in his head to fly over the earth's surface at the not very moderate rate of ninety miles an hour ; at others he is content with a few miles in that time. Whatever he does, his pace is infallibly noted. A cylinder revolves by clockwork. When there is little wind, a pencil which touches the paper on the cylinder travels along it horizontally, but when there is much wind it travels across it more or less perpendicularly, as it were. Thus the inclination at which the pencil line runs round or along the paper indicates the rate at which the wind has passed over the earth's surface. Sometimes it will go for a day right along the cylinder — that will show calm ; sometimes it will go a little way along, then suddenly begin to move across it, or at any rate to incline downwards : that would indicate that from a calm there had suddenly sprung up a considerable breeze. Self-recorders are connected also with (1) the barometer, the rise and fall of the mercury being continuously photographed, (2) the magnetometer which, placed in a cellar, marks any magnetic disturbance underground, the movements of the needles being photographically recorded by an ingenious arrangement of

BEN NEVIS OBSERVATORY.—WINTER.

BEN NEVIS OBSERVATORY.—INTERIOR.

lights and mirrors, and (3) a temperature and moisture indicator. The rain gauge in the garden is a receptacle provided with a funnel through which the water runs, and the depth to which the earth would be covered if it were flat and there were no means of escape for the water, is recorded by a lever, which moves a pencil, the pointed end of which touches a piece of cardboard. Even lightning is made to record itself. A little stream of water for ever running through a pipe projecting from the wall of the observatory picks up any electricity in the air, and carries it into an instrument, which automatically notifies its presence.

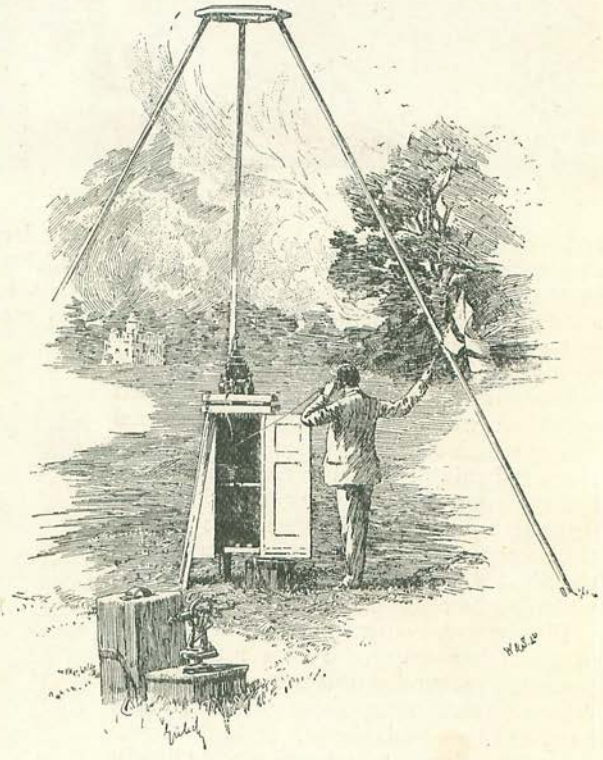
Photography enters largely into the work of the Observatory. By its means it is possible to secure records more reliable and more complete than those of the human hand and eye could ever be. In taking a picture of the clouds, to determine their height and rate of motion, one operator stands on the roof of the Observatory and another is placed half a mile away across the park. The two positions are connected by the telephone, and both men expose their plates at the same instant, so that the cloud is caught from the two points simultaneously. Photography has also, as Professor Huggins in his fascinating address before the British Association in August last showed, been of incalculable service in enabling the astronomer to learn more and more of the marvels of the heavens. Innumerable stars which are invisible to the eye of man through however powerful a glass, are caught by the sensitive dry plate, and, as will be seen from our picture of the sky at night (for which we are indebted to the Editor of *Knowledge*), their number is very great. The large, diamond-like star is one of those which are visible to man's naked orb. At Kew, however, astronomical photography has been limited to investigations of the



OUTSIDE THE DOME, KEW.—THE ANEMOMETER.

changes taking place in the solar surface. The labours of the Observatory in connection with the sun have been so persistent that photographs taken by the large telescope in the dome of the Observatory exist from 1859 to quite recently. Placed on the roofs so that they may catch any ray of sunshine there may be, are two sunshine recorders. One is a bowl of wood, over which is placed a spherical glass three or four inches in diameter; the other is a brass bowl, inside which is a specially prepared piece of blue cardboard. When the sun shines on the first it burns the wood away, and as the bowl remains there for six months, the amount of wood charred shows what "bright Phœbus" has been doing to gladden this earth of ours during that time; the second records his appearance through one day only. When the sun shines it burns a line on the cardboard, and his disappearance for any length of time is notified by the absence of the charred line. The notion here turned to scientific account is precisely that of the smoker whose matches have failed him. If the sun be shining he takes a spectacle glass, and holding it between the sun and his pipe, secures a light.

Rapid as has been our glance at the operations of both the Meteorological Office and one of the principal observatories associated with it, we have said enough to show their importance. When one thinks of the accumulation of meteorological minutiæ which is resulting from the preservation of the reports from so many places as to the wind, rain, sunshine, and all the rest of it, one may be tempted to ask whether it is worth the trouble it involves? If the observations are of use to those who want to know the probable state of the weather during the next twenty-four hours, where can be the utility of tabulating them year after year with as much care as is exercised in the registering of births, marriages, and deaths? Well, many an agriculturist would give a satisfactory reply to this question. Suppose he wishes to ascertain the amount of moisture his land is likely to require. The Meteorological Office can inform him precisely as to the average quantity of rain which has fallen in his district for years past. Or, supposing one is particularly anxious to ascertain the climatic character of a place where one is thinking of living, or to which one wishes to send an invalid friend. To learn whether the place is dry or damp, windy or quiet, one has only to go to the Meteorological Office, and the chances are its pigeon-holes will supply the very information wanted. Or, say, a civil engineer is about to build sewers in some new locality. One of the things he has to guard against is making them too small



CLOUD PHOTOGRAPHY.

to carry off the rain water which is likely to fall. But how is he to tell whether the normal amount is little or much? He applies to the Meteorological Office, and they can inform him not only how much rain fell on an average every hour of every day in the last twenty years, but exactly how often there had been exceptional downpours, which would make great demands on the drains. The civil engineer thus learns precisely what it is of the utmost importance he should know. Or, to look at the matter from another point of

view, take the question of bridge building. The bursting of a sewer is undoubtedly a serious matter, but the overflowing of a river is more serious still. During last year, it will be remembered both in Australia and in Spain terrible floods occurred. Hundreds of lives were lost, thousands of men and women were rendered homeless, and thousands of pounds' worth of property was destroyed. In both cases—and the coincidence is one which, so far as we know, has never been pointed out—the disaster was attributed to the presence of bridges which were so built that they practically formed dams. In ordinary conditions they did no harm, but when there came an exceptional volume of water, the structures prevented it from getting away down the proper channel, and the country was inundated, with consequences of the most tragic character. In the future, no bridge not already built ought to be responsible for such a catastrophe. Weather watchers and recorders will be able to tell the engineer what is possible, if not probable, and he will construct his bridge accordingly. However much, therefore, we may laugh at the meteorological prognosticator, we cannot deny that the work of meteorology is of the very highest utility.

A STAR PHOTOGRAPH.