### The Sun.—No. 5.

[Concluded from page 363.]

MESSRS. EDITORS—It may be asked, what is the nature of the luminous coating of the sun? Is it a liquid or a gaseous substance which is susceptible of such agitations? When we consider the vast changes which are going on in this stratum—chasms having many times the area of the earth's surface opening and closing again in a few weeks, or even days—it must be admitted that it has an extreme mobility, and a tenuity which seems incompatible with any other state of matter besides the atmospheric or gaseous. That it is a gaseous substance may no longer be left to the domain of mere conjecture. By the experiments of recent physical inquirers—foremost in the list of which we must place the name of the late and distinguished M. Arago, of France—combined with observations on the solar disk, we are indisputably shown that the luminous matter of the sun is gaseous in its properties, Two kinds of light, natural and polarized, are known to philosophers. When a luminous body, whose light is natural, is viewed with an instrument called the "polarizing telescope," two equally luminous and perfectly white images of the body are seen; but if its light is polarized, these images appear no longer white, but tinged with complementary colors. It has been proven that if the light of the sun proceeded from a solid or liquid body, that its margin must present marks of polarization by giving colored images in the polarizing telescope; but if it comes from a gaseous body it must be in its natural state. Repeated observations on the sun show that his light is unpolarized, and gives perfectly colorless images in the polarized instrument. Hence his light is in the state of that of an incandescent gaseous body.

The facula and luculi are probably caused by portions of the uneven photosphere, like flakes of clouds, being inclined so as to be seen very obliquely or edgewise, which thus appear more brilliant than the surrounding and less inclined portions. They, too, like the dark spots, denote constant changes going on in the photosphere of the sun.

We have strong evidence of the existence of a solar atmosphere of no inconsiderable hight, exterior to the photosphere. This atmosphere is generally invisible in the glow or radiations which appear to surround the sun, and are caused by the reflection of his light on the particles of our own atmosphere. The effects of his atmosphere which is not perfectly transparent, may be observed in the light from the different parts of his disk. The disk is found to be less luminous near its borders than at its central parts; the reverse would certainly be the case was he not surrounded by an absorbing atmosphere, whose effects would naturally be much stronger on the light from near his margin. But the phenomena of his atmosphere are much more striking and conclusive during total solar eclipses. When the moon entirely covers the face of the sun, whose rays can no longer meet our atmosphere above the observer, she is uniformly seen to be surrounded by a bright halo of light, which gradually fades away at some distance from the lunar orb. It has been proven that the moon has no surrounding atmospheric medium capable of producing such a phenomenon; hence, this glare of light must be the reflection of the solar rays from the particles of his own atmosphere.

Other more curious phenomena are often observed during solar eclipses. Just as the advancing edge of the moon has completely covered the solar disk, numerous rose-colored jets are seen to dart forth, as it were, from the dark edge of the lunar orb, sometimes attaining a hight of 3 or 4 minutes. Several opinions have been advanced for the purpose of explaining the cause of these strange appearances. The theory which appears most compatible with observation is that which regards them as very attenuated clouds floating in the solar atmosphere and reflecting his light. Their outlines are usually serrate or irregular, and recently, in one or two instances, they have been observed to be entirely detached in appearance, from the edge of the moon. This shows that they are nothing which rest on the surface of the sun, like lofty mountains, but rather float above this surface, and even high above his photosphere. Taken for clouds near the sun, they must often be of great dimensions, some ranging from 70 to 90 thousand miles in length.

It is evident that the temperature of the sun's photosphere cannot be otherwise than very elevated. It must be infinitely more so than any artificial heat which can be produced. We know that the intensity of light and heat decreases as the second power of the distance increases. From this it has been computed that the heat of the solar rays at his surface is no less than 300,000 times their temperature at the distance of the terrestrial globe. [See Herschel's Outlines of Astronomy, Art. 396, for an elucidation of the temperature of the photosphere.] A much less degree of condensation of the solar rays by lenses or specula will suffice to dissipate the most infusible metals, in vapor. The most vivid flames and strongly ignited solids, when projected in perspective on the solar disk, appear like black spots, so intense is his radiation. From this, it appears that although the body of the sun seems to be black through the openings in his luminous covering, yet was his photosphere removed he might be quite luminous; but this is not necessarily the case. Notwithstanding that the temperature of his photosphere is so elevated, that of the solid globe of the sun may not be very great; for, as we have seen, it is shielded from the radiation of his luminous and calorific envelope by a thick cloudy stratum. If this cloudy stratum, which is supposed to rest on a highly elastic gaseous medium of great density, is exceedingly reflective, (were it otherwise, we should be unable to perceive it as a penumbra about the spots) we may with good reason suppose that the body of the sun receives but a little more heat from his luminous atmosphere than we do on the surface of the earth.

The quantity of heat which the sun gives out into the surrounding space during one year is enormous. This immense radiation, however, does not appear to diminish the intensity of his rays in the least during any period of time; therefore some powerful means of keeping up a continual and generally equally incandescent state of his photosphere must exist in his system. By what means this is effected physical researches have hitherto fallen far short of pointing out. We cannot even conjecture the cause with any degree of probability. Of all the agents which we know, the one which would be more probable to maintain such a constant phenomenon is electricity or magnetism. The phenomena of this agent on the earth, the *aurora borealis* and the like, sink into comparative insignificance beside the immense physical operations of the solar photosphere.

The solar rays go far in influencing terrestrial phenomena. By their agency, winds and circulations of air are produced; watery vapors are raised aloft and wafted over the land, falling again as rain, sleet, hail, and dew; and vegetation is brought forth, cherished, and attains to maturity. By their means are caused the dawning aurora and evening's *crepusculum*, the solar and lunar halves, and the brilliant *parhelia*, the golden hues, and the scarlet tinges of the clouds, the azure of the sky, and the beautiful rainbow. They give the green tinges and beautiful colors of the vegetable world, and cause their odors and resinous effusions. The currents of the ocean and electric phenomena of the clouds, as well as many other operations, are dependent wholly or in part on their presence.

STILLMAN MASTERMAN.

[For the Scientific American.]

### Slate Roofing.

In the SCIENTIFIC AMERICAN of June 14th you say you have recently received a number of letters requesting information respecting a good and cheap material for roofing houses, then follows some remarks relative to cement, tin, &c., while slate are merely named, and passed in silence.

I would therefore beg the privilege of saying that in this vicinity roofing slate are being quarried which, I believe, possess every quality of the Welsh Bangor quarries, and when the durability and safety are taken into account I believe a roof will be found to be cheaper than any other material. I was shown a roof two years since that had been on 100 years, at least, the dwelling was built in 1754; the slate was still unimpaired, and may last 200 years more; the building was to be taken down and the slate to be relaid.

The slate can be furnished on board cars on railroad here for $3·50 per square, that is, 10 feet square when laid on the roof, and transported to New York for $1 per square, to Buffalo for $1·83.

The expense for laying is about the same as shingles, and can be laid as easily and by the same workmen. The roofing-boards are put on the same as for shingles, and when the slate are on, shelter from fire, rain, or snow, so far as the roof is concerned, may be found during several generations; being tighter than shingles slate never shrink or swell, and these slate do not absorb water, therefore heat or cold does not affect them. GEO. N. BATES.

Middle Granville, N. Y., Aug., 1856.

[The letter of our correspondent surprises us. We have on more than one occasion recommended slate for rooofing, as being the best fire-proof material for this purpose; but we did not class it among the materials for cheap roofing in the articles which recently appeared in our columns on the subject. He, however, makes it to be a cheap roofing material—even cheaper than tin, the cost of which is $7·50 per square for common plate, $8 for charcoal plate, and ranging from $9 to $10 for that of superior qualities. The roofs for slate require a greater pitch than for tin, and also stronger framing; but the framing of most of the stores built in this city, we presume, is strong enough. He is mistaken in supposing that slate can be laid on roofs with as great facility as shingles; they require a great deal more care and skill.

### Boucherie's Process for Preserving Wood from Decay.

A number of cotemporaries have recently published extracts from the Report of the French Exhibition, setting forth the advantages of Dr. Boucherie's process for preserving railroad sleepers, telegraph posts, &c., from decay, but these extracts do not describe, but rather mystify the process.

About eighteen years ago Dr. Boucherie, of France, suggested the application of the aspirative force of trees for the rapid and more perfect impregnation of wood, with some antiseptic, to prevent its decay. His plan consisted in taking a tree recently felled, and placing its base or butt in a bag of india rubber fastened tight around its mouth, but connected at its bottom by a pipe with a cistern or reservoir containing the preserving liquor.

The best season of the year, according to Dr. Boucherie, to impregnate trees in this manner, is the autumn. The principle of action taken advantage of, is that of the flow of the sap from the root by the innate force of the tree. About the same time that Dr. Boucherie suggested and tested this method in France, John Bethnell, in England, took out a patent for an identical process, in July, 1838.

When Boucherie published his process, a Commission of the French Academy of Sciences, appointed to investigate its merits, reported very favorably of it; this committee consisted of such distinguished men as Boussingalt, Arago, Poncelet, and Audouin.

This process was afterwards improved by Dr. Boucherie, by elevating the base or butt of the tree uppermost, and it is by this method that the sleepers and telegraph posts were treated, which are spoken so highly of by the Jury of the French Exhibition.

The newly felled tree is stripped of all its superfluous branches and divided into convenient lengths, and the preserving liquor applied in the india rubber bag at the butt, at the uppermost part of the tree or log—if cut into logs. If the butt is scooped out like a bowl, to hold the liquor, the india rubber bag is not required to hold it, but more liquor must be supplied as it forces itself down through the pores of the tree. In most cases the liquid penetrates rapidly, expelling the sap before it, by its gravity, and the operation is terminated whenever the liquor, which flows out at the bottom, is similar to that at the top.

Some trees are more difficult to impregnate than others; the most porous are not always the easiest.

This process is not so applicable to seasoned timber, the pores of which should be exhausted of air by an air pump, and the preserving liquor applied under pressure.

The pyrolignite of iron was the first antiseptic employed by Dr. Boucherie, but he now uses the sulphate of copper.

In the year 1846, 80,000 sleepers thus prepared, were authorized to be laid down upon the Northern Railway of France, together with a certain quantity of unprepared sleepers. In this instance, the Company chose wood that decays easily, and which, on that account, had been rejected for durable works.

These sleepers were inspected every year, and each time were found in a good state of preservation.

The following is an extract of a report upon the subject addressed to the jury of the late Exposition, by the administrators of the Northern Railway of France:

"The sleepers prepared by Dr. Boucherie's process are preserved in an absolute manner, it being impossible to foresee a limit to their duration, seeing the present perfect state of preservation exhibited by those sleepers laid down eight years ago.

Since the year 1853, the Northern Company has ordered more than 300,000 sleepers prepared by this system, and further orders would have been given, if they had found contractors disposed to deliver upon the same terms; however, at the present time tenders are required for more than 200,000 of those sleepers."

The following is an extract from De Vougy, Chief Administrator of Telegraphs in France, on telegraph posts:

"PARIS, August 14, 1855.

Sir:—All the telegraph posts in the French Empire have been prepared by your process. The administration had 200,000 on the 1st of January last, and since that time have caused 32,000 additional posts to be prepared. The preservation of the posts thus injected with sulphate of copper is rendered complete, although the first were prepared and laid down in the year 1848."

This method of preserviug timber is very simple, and can be carried into practice at a small expense in our forests, where the trees are felled and sawed into logs.

For railroad sleepers, timber so prepared would effect a very great saving of expense to all our railroads. In Lowell there is a factory for preserving timber by the use of a solution of chloride of zinc (Burnett's process,) which is a good preservative, but this is the only factory of the kind, we believe, in our country, thus showing that there is but little demand for preserved timber; and that our railroad companies are not yet sufficiently impressed with a true sense of its economical value.

Boucherie's process is public property; logs may be impregnated on his principle, if set at angle butt up, and not perfectly vertical, so that a cheap staging may be put up, and two or three men accomplish all the labor connected with it in the midst of any forest in our country.

### Electro-Chemical Baths.

I notice in your journal of July 26th, on page 363, an article from Mr. Smith, who, although possibly something of a magnetist, is, to judge from his writings, very little of an electrician.

Mr. Smith does not seem to be aware that the irradiations of electricity are subject to the same laws as those of heat and light, and that a proposition which supposes that any metal folded in layers will cause as much irradiation as the same will when its whole surface is exposed, is, to say the least, an absurdity.

As well might Mr. Smith maintain that a folded or closed umbrella would be of as much protection, in warding off the rays of the sun, as the same would when opened. For an answer to the other portion of his article, I refer your readers to my article of July 6th.

New York, Aug., 1856. M. VERGNES.

### Australian Gold.

No less than $100,000,000 of gold were obtained in Australia in 1855, and during the first three months of the present year no less than $30,000,000. Brother Jonathan and Uncle John appear to be in luck with regard to their gold discoveries.