Correspondence.

Image of the Sun as a Measure.

To the Editor of the Scientific American:

I noticed in the SCIENTIFIC AMERICAN for October 2, 1886, the following communication from a Mr. Shields, of Coopwood, Miss., in which he gives a method for determining the permanent length of an inch as a unit of measure: "Take a plain mirror, on the equator, at noon on any certain day, and get the size of the sun's disk, which will be about an inch. This will be the same size on any meridian at noon, and unchangeable."

I would beg leave to state some objections to his method of arriving at this standard unit of length:

1st. According to the theory of contraction, the sun's diameter is diminished about 220 feet per year, or about 4 miles per century. Therefore, the diameter of the sun is not a constant quantity. This fact alone would make it theoretically not correct.

2d. If you tried to find the exact diameter of the sun's image in a mirror by traveling around the equator, it would vary, because the sun is not always exactly vertical on all parts of the equator. It is only vertical on two points.

3d. The personal equation with different persons would vary, and therefore render the unit of length derived in this way variable. GEO. I. KING.

York, Pa., Oct. 7, 1886.

Lime and Cement.

To the Editor of the Scientific American:

In your issue of the 9th inst., page 231, you print an article entitled "Cement in Ireland," signed by one Robert Mallet, F.R.S., in which he states that Henri Sainte-Claire Deville, the illustrious French chemist, in the course of certain recent researches discovered that some certain compounds of hydrate of lime and hydrate of magnesia afford a cement of eminently hydraulic qualities, setting rapidly under water; that the natural dolomites, if calcined at a very low red heat and ground to powder, produce, without any other treatment, a fast setting hydraulic cement, which becomes so hard that it may be employed as an artificial stone.

Mr. Mallet further adds: "The process which has been given to the world by Deville is hampered by no patent."

The process is not confined strictly to dolomitic rocks. Any magnesian limestone will answer the purpose fully, so Mr. Mallet states. Every few years some one discovers (!) that an eminently hydraulic cement can be produced from pure magnesian limestone; and, singularly enough, the discovery is invariably given to the world free. It is never "hampered with a patent."

This story generally follows in the wake of the sea serpent story that we always like so well to read about. It is always fresh, always inspiring.

Probably three-fourths of the quicklime manufactured in this country is derived from the magnesian limestone formations. When this stone is calcined sufficiently to expel the carbonic acid, it is called quicklime; and when water is applied it gives off heat, expands, and falls to powder. It is then a hydrate of lime and hydrate of magnesia.

In this condition it is mixed with sand and water, and becomes mortar for masonry and plastering. The lime and magnesia are not chemically combined. It is simply a mechanical combination when in a pure state. They are both bases, containing no acid with which to form a salt.

Taken singly or together, neither of them contains the slightest trace of any setting or hardening properties.

They are, however, the bases that when intimately mixed with certain proportions of silica or silicic acid, and subjected to a high heat, produce silicates of lime or lime and magnesia, *i. e.*, a hydraulic cement.

When water is applied to these silicates, they crystallize and harden, whether in air or water, and will not dissolve by the action of water, while pure lime and magnesia, either singly or as a dolomite, will dissolve in water—will be taken up and held in solution. This result cannot be changed by any manner of calcination or subsequent manipulation.

Not long ago an article appeared in one of the trade journals stating that "the only way to produce silicate of lime was to mix common white or quicklime and sand together with water, and pile it up in a heap, and at the expiration of two or three weeks the whole mass would have become silicate of lime." This idea seems to be quite prevalent, but its absurdity is easily exposed; for, no matter how old the mortar may be, if the lime was pure and white, a few days' immersion will dissolve the mortar, thus proving conclusively that there is no chemical combination between the sand and lime.

A true silicate of lime cannot be dissolved by water. Impure limes, such as the gray or brown limes, always contain silica. Five to six per cent will not prevent active slaking, and the resultant mortar will contain 15 to 18 per cent of true silicates, and even this amount will tend greatly to the hardening of the mortar. It was probably through the use of these impure limes that people have been led to imagine that pure limes contain inherent setting properties—a theory that never has and never can be sustained. U. C.

Buffalo, Oct. 12, 1886.

The Total Solar Eclipse of 1886.

A correspondent of the London *Times* gives a brief general account of the results of the recent British expedition to Grenada, South America, from which we take the following:

In the eclipse observations secured in Grenada and Carriacou, a distinct advance has been made. New facts have been acquired, old views have been satisfactorily tested, new instrumental methods have been studied, and records of the general phenomena have been secured.

As to the new facts. For these we have to refer to the work of Prof. Tacchini, at Boulogne. No one was more competent than he to note the prominences and other appearances visible during the eclipse. This he did with a 6 inch; and so soon as the clouds permitted after the eclipse, he observed the spectrum of the prominences by the ordinary method. He found that the prominences seen under these two different conditions and by means of such different methods were not the same. He also noted that the prominences seen during the eclipse itself had the same characters as the so-called "white" prominences which he observed in 1883 at the Caroline Islands. These appear whiter and dimmer as the distance from the photosphere increases. These observations have been very closely examined by Prof. Tacchini and Mr. Lockyer, with the result that both these solar observers are now prepared to ascribe these new phenomena to the descent of relatively cool material.

It is difficult to overestimate the importance of this result from the point of view of solar theory. The determination of the direction of the currents in the solar atmosphere is indeed so important that it was included in the programme of the observations to be made by Mr. Turner with his 4 inch finder, but no certain results were secured by this means, as the structure of the corona was apparently unusually complicated. In the spectroscope, however, one long streamer was observed to be much brighter near the limb. This is not absolutely conclusive evidence, but it has its value.

To return, however, to Prof. Tacchini's other observations. He found that the prominences which were visible both during totality and by the ordinary method presented very different appearances, so that we are driven to the conclusion that by the latter we only see part of the phenomena. This entirely accords with Mr. Lockyer's recently published views, in which it is suggested that the metallic prominences seen near spots are really mixed up and down rushes, with probably an excess of the cooler descending material. Thus, for instance, the metallic prominences observed by the ordinary method after the eclipse were found to be only the central portions of those observed during totality, the part visible only during totality forming a whitish fringe round the more incandescent center. Another very important observation was made. The "flash" of bright lines, attributed by Prof. Young to the existence of a thin stratum which was supposed to contain all the vapors the absorption of which is registered by the Fraunhofer lines, was found to be due solely to the great reduction in the intensity of the light reflected by the earth's atmosphere allowing the spectrum of the higher regions to be seen the moment the lowest stratum of the corona was covered by the moon. This is carrying the unveiling of the spectral effects by the increasing darkness recorded in the Egyptian eclipse to its furthest limit, and it harmonizes all the observations of this kind made since the eclipse of 1870.

About twenty photographs of the corona have been obtained in all, and five photographs of the chromosphere and lower regions of the corona. Mr. Maunder obtained seven of the corona, and could have obtained more, at Carriacou. Captain Darwin obtained six, and Dr. Schuster, we believe, five, at Prickly Point. Of the photographs, seven spectra, two with the solar spectrum on the same plate—the only ones worth anything—have also been secured by Mr. Maunder.

Among the records obtained on this occasion must be classed the disk observations, now for the first time included in the ordinary routine of eclipse work. The point of a disk observation is that an observer is by its aid able to observe the outlying solar appendages under the best conditions, so far as the sensitiveness of the eye is concerned. For ten minutes before totality the observer is blindfolded, and at the moment of totality he is led to a small aperture through which, the bandage over his eyes having been removed, he sees a black disk some forty feet away, which shuts off the moon and the brighter interior portion of the solar atmosphere. The eye, therefore, being thus shielded, is in the best position to pick up faint streamers extending beyond the borders of the disk, and to note their positions and extension.

Streamers were thus noted at Grenada, extending far beyond the limits seen in the ordinary way, but the air was so saturated with aqueous vapor and incipient cloud, even where substantial clouds did not make their appearance, that the failure of any of the observers to see the equatorial extension observed by Prof. Newcomb in the clear sky of Wyoming, at an elevation of 7,000 feet, in 1878, by no means proves that the extension was not there. The question of the continual existence of an extension of matter of some sort or other in the plane of the sun's equator must be held to be still *sub judice*.

Damaskeening.

The figuration presented by the surface of steel and iron guns, small arms, etc., and also the plain brown or black surface of modern steel guns, is known as "damaskeening," and is produced by treatment with weak acids, which act unequally upon the different parts of the metal under treatment, the harder portions of the metal becoming covered with a thicker film of carbon than the softer portions. The color of these thin films varies from light brown to black, according to the more or less prolonged treatment with the acids. If the figuration is not sufficiently elaborate, owing to the metal not having sufficient fiber, and to the fiber being too straight and regular to produce the desired effect, it is customary for the makers of fowling pieces and other light goods to paint or stencil a pattern on the surface of the metal with the acid, and in this way the figuration can be made as effective as desired. The solutions largely used at many works are as follows:

For steel, sulphur 1 oz., tincture of steel 1 oz., nitric acid 1 oz., sulphuric acid ¼ oz., mercuric chloride ½ oz., copper sulphate ½ oz., spirit of niter 1 oz., water 1 qt.; for iron, tincture of steel ½ oz., nitric acid 1¼ dr., mercuric chloride 1 dr., copper sulphate ½ dr., spirits of wine 6 dr., water 8 oz. The solution used at Woolwich and Elswick for steel guns, etc., is as follows: Tincture of steel 2 oz., nitric acid 1 oz., copper sulphate 1 oz., spirit of niter 1½ oz., spirits of wine 1½ oz., water 1 gal. This is a much better solution, and works remarkably well; it is smeared over the parts, and when dry another coat is put on. This will produce a brown color; but if it is not dark enough, the operation must be repeated until the desired tint is obtained. Six coats are sufficient to make the surface black. The acid is then killed by washing with soda solution, and the surface rubbed with a hard brush or "file card" until smooth, after which it is rubbed with oily waste. For iron there is nothing better than mercuric chloride or antimony chloride, dissolved in water, with a little spirit of wine added to help it to dry. The action of these reagents will be readily understood by those acquainted with elementary chemistry, and it is therefore unnecessary to describe them. All the weights given are avoirdupois.

Water Power in Cities.

Some idea of the large amount of water required to drive even a small motor may be gained from the following by James Emerson, in the *American Engineer*:

Ordinarily, 60 gallons in each 24 hours is the allotment per each inhabitant for cities. Some one has estimated the average under which the water of cities is distributed to be 60 feet, undoubtedly an overestimate, for though in exceptional cases there are places where the head is from one to two hundred feet, it is far more often the case that the upper rooms of hotels and residences in cities cannot be supplied from the pipes, and particularly so since the erection of the lofty structures now so common. But as a working point, suppose the average to be 60 feet; 0·1469 cubic foot of water per second, or about 66 gallons per minute, falling 60 feet, equal one horse power, or six gallons more than the allowance for an individual for 24 hours, is required each minute to produce one horse power, or, if used ten hours per day, the supply for six hundred inhabitants.

For an actual horse power necessary to drive a printing press or other machine a quantity of water sufficient to supply from twelve to twenty-five hundred persons will be required, that is, if the said machine is driven ten hours per day. Can cities afford to furnish such a supply, and more particularly so where the water is pumped? For, for every horse power distributed to various parts of a city through small pipes, valves, and abrupt turns, at least two horse power are expended at the pumping station. There are other obstacles that cannot be overcome. Where the water is taken from a lake, as it is at Chicago and Milwaukee, the city authorities have control, but in most cases the supply is taken from rivers, ponds, or lakes owned by manufacturing companies, and though such water may be taken for domestic purposes, not one drop would be allowed to be rented for power.

There are exceptional cases where cities acquire the entire supply in anticipation of increased population, and for the time being there is a surplus that may be used for power instead of running to waste. In such cases a simple turbine or impact wheel will be found by far the most economical in first cost and use of water. It will be desirable, however, to place them where their humming will not become unpleasant.