

Correspondence.

The "Shadow Bands" of the Solar Eclipse.

To the Editor of the SCIENTIFIC AMERICAN:

I went to Pinehurst, N. C., to view the solar eclipse on the 28th ult. Our position was close to the central line of the shadow path, and we saw all the phenomena successfully, the sky being perfectly clear.

I was particularly interested in the "shadow bands," those curious little undulations of light and shade which appear for a few moments just before and after totality, and whose cause does not appear to be very well understood as yet. It may interest some of your readers to know just how they appeared, and perhaps I may be allowed to suggest a possible explanation of them.

Immediately in front of the house from which we were watching the eclipse, there was a broad level walk of whitish sand. About five minutes before totality, we began to notice on this walk a peculiar appearance as of very fine wavy lines moving in the direction of the eclipse, at the rate of perhaps ten or twelve feet a second. The lines or shadows were at right angles to the direction of the eclipse, and did not seem to be continuous, but broken and somewhat irregular, with an uneven, rippling motion. If you will imagine a shallow pool of clear water, perhaps a foot deep, with a white sandy bottom; and further imagine the surface of this pool to be ruffled by a fresh breeze, causing a progression of ripples six or eight inches apart, then the shadows of these ripples on the bottom of the pool would be more similar to the appearance of the "shadow bands" than anything else I can think of. They differed considerably from the representations I had seen of them in previous eclipses, when they are generally figured as broad alternate bands of light and shade. I should say that "shadow lines" would be a more appropriate designation than "shadow bands."

As to the cause of the phenomenon, the fineness and closeness of the lines makes it evident that it must be sought for close to the earth's surface. Such delicate shadows could not be cast by any object very far away. As I watched the motion of these curious lines, I could hardly resist the impression that they were caused by the undulations of a stratum of heated air passing directly above our heads. In point of fact, it was getting so cold at this time that we had to put our wraps on. After totality the same appearances were noted.

The governmental eclipse party at Pinehurst had at their observatory a large white sheet stretched at an angle with the earth's surface and directly facing the sun. One or two observers were detailed to watch the "shadow bands" on this, but they were only faintly seen, not as well as on the level ground, and I was told by some that they saw them distinctly on quite rough ground. This would indicate that whatever caused them, they moved on a level with the earth's surface rather than on a line with the moon's motion across the sun.

The conclusion I arrived at was that the passage of the moon shadow caused an undulatory motion in the atmosphere close to the earth, whether thermal, or electrical, or mechanical, I am not prepared to say. This wave motion would naturally be slower than the speed of the shadow, just as waves upon water are slower than the wind which produces them, and the slender crescent of the almost eclipsed sun would throw much finer shadows of these undulations than if his disk were wholly unobscured.

A. W. COLGATE.

Morristown, N. J., June 7, 1900.

The June Building Edition.

The SCIENTIFIC AMERICAN BUILDING EDITION for June has many interesting articles and engravings. "Architecture and Citizenship" is by Prof. A. D. F. Hamlin. A summer residence and casino at Sound Beach, Conn., are very attractively shown. The great dining hall of the "Breakers," at Newport, R. I., is illustrated by a full-page engraving. "An Artist's Home in Oakland, Cal.," illustrates the unique dwelling house which was built by Mr. Peano, instructor of sculpture in the Lick School of Mechanical Arts at San Francisco, and most of the details are the handiwork of his students. There are as usual a number of moderate-priced houses, and in each case the floor plans are given and there are some interiors.

TARDY justice is at length to be done to another of the many martyrs of science in the person of Prisse d'Avennes, the discoverer of the famous maxims of Ptah Hotep, which has been claimed as the oldest book in the world, says Biblia. Prisse d'Avennes was a munificent donor in his time to the museums of Paris, and most patriotically refused all offers from other nations to work for them as an archæologist when the trade of exploring was more highly paid and less crowded than it is to-day. He died in poverty at the age of seventy-two, and his grateful country has now named a street in Paris after him and proposes to place his bust in the Egyptian Museum of the Louvre.

Science Notes.

In the SCIENTIFIC AMERICAN for February 24, 1900, we illustrated the remarkable twins Rosalina and Maria, who were born joined together in much the same manner as the Siamese twins. An operation was recently successfully performed upon them at Rio Janeiro, and they were cut apart.

The Brooklyn Institute of Arts and Sciences has broken ground for the central section of the Museum on the Eastern Parkway. The new section will have a frontage of 140 feet on the Parkway and a depth of 122 feet. It will be four stories in height, and the ground floor will have an auditorium capable of seating 1,250 persons.

A new species of petrel has been discovered on the island of Kauai (Sandwich Islands) by a Stanford University graduate, Mr. A. Searle. He has also found on the same island a new species of sea gull. He is going to Guam to explore that island and to make a collection of birds and fishes for the famous Bishop Museum of Honolulu.

A section of the tree which was over David Livingstone's grave has been received by the Royal Geographical Society of London, and placed with the other Livingstone relics in its possession. An iron telegraph pole now marks the spot where the great African explorer breathed his last. The huge block of wood was carried on the shoulders of the natives from the heart of Africa to the coast.

The curved pages of an ordinary book are injurious to the eyes. Mr. F. G. Murphy shows that the curved page causes a constant change of the focus of the eye as it reads from one side to the other, necessitating a continued effort on the part of the ciliary muscles. The light also falls unequally upon both sides, further interfering with a continued clear field of vision. He, therefore, suggests that the printed lines run parallel to the binding instead of at right angles to it, so that all parts of the line would be at an equal distance from the eye and be equally lighted.

The National Academy of Sciences of the United States has recommended to the trustees of Columbia University that the Barnard medal for meritorious service to science be given to Prof. Roentgen for the discovery of the X-rays. The award will be made at the Commencement of the University on June 13. The gold medal was established by the provisions of the will of the former President of the University, the late Prof. F. A. P. Barnard. It is awarded every quinquennial period to any person who shall have made such discovery in physical or astronomical science as in the judgement of the National Academy of Sciences shall be esteemed most worthy of the honor.

For several months past experiments have been conducted at Sassari, in Sardinia, by Dr. Fermi, Dr. Cossul-Rocca, and Dr. Lumbau, for the purpose of ridding that town of the pests of mosquitoes with which it is overrun. The doctors effectually destroyed the larvæ by distributing vast quantities of petroleum in the swamps and other spots where the insects bred, and the mosquitoes were exterminated by chlorine and other powerful destructive chemicals. The doctors in their report consider it possible to free any town infested with mosquitoes by this means, provided it is not too unfavorably situated. It is an economical remedy, costing only about \$250 per annum for a town possessing a population of about 50,000 inhabitants.

The Nuova Cimento contains an interesting article by P. Gamba giving the result of his experiments upon the elasticity of marble. Plates of marble were impregnated with different liquids, and the effect measured. The experiments are best carried out with water, as by drying, the marble may be slowly brought back to its original condition, the curves of deformation being the same before and after the action. The deformation is greater for the wet plate, and the residual effect is also greater; there is thus a considerable increase in the flexibility of the wet marble. Oil, glycerin, and solutions of paraffin give similar results, although the marble cannot be forced from the liquid and brought back to its original state as with water. Petroleum, however, causes no difference in the flexibility. Glycerin gives the greatest effect.

Every soldier in the British Army carries in his haversack what is known as the "Emergency Ration." This consists of a small tin cylinder, similar to a pocket spirit flask, divided into two compartments. One of these is filled with 4 ounces of cocoa paste; and the other contains a similar quantity of concentrated beef (pemmican). As its title implies the ration is not to be used except in the cases of direst necessity, and if consumed in small quantities it will maintain strength for 36 hours. The tin has to be produced at parades and daily inspections, and the soldier who does not display his ration is severely dealt with. The tin must not be opened on any account, except by order of an officer. The ingredients may be either spread upon a biscuit like butter, or boiled up as cocoa or soup. Each tin contains sufficient quantities of the foodstuffs to make four pints of each.

Engineering Notes.

The Baldwin Locomotive Works, of Philadelphia, have received an order from the Egyptian government for twenty locomotives for the Egyptian Railway.

25,816 vessels passed through the Baltic Canal during the year ending March 31, 1899, the aggregate tonnage being 3,117,840; the total receipts amounted to \$388,000.

Work on the remodeling of the Grand Central Station, New York, is being carried on steadily. The new waiting-room will be 70 to 190 feet, and a wide concourse will be built across both train sheds between the waiting-room and the southern end of all the tracks. The regular train service has not been interfered with during the alterations.

One of the express trains running between New York and Boston has twin headlights. They focus on the rails a hundred yards or so ahead of the engine at the points where the greatest illumination is desirable, and diverge beyond over the surrounding fields and farmhouses, and enabling the engineer to see along the curves. With the new twin lanterns one arm or the other of the X of light reaches along the curving track.

A Philadelphia bridge building company has obtained a contract for the new steel bridge across the St. Lawrence River at Quebec. The bridge will be 4,000 feet long and 150 feet above the river, thus enabling the largest ship to pass under. It will consist of three spans, two of 500 feet each and the center one of 1,800 feet. The bridge will be 60 feet wide, containing a roadway, four railway tracks and walks on each side.

A plan is now before the Italian Parliament for providing the three southeastern provinces of Foggia, Bari and Lecce with water from Caposele in the Apennines by building an aqueduct 163 miles long with branches that will bring up the total length to 860 miles. The land is very productive, but suffers in summer from drought and malaria. The present water supply of the district is drawn largely from swamps. The projected aqueduct would cost \$32,000,000 and would supply 288 towns and villages having a population of 1,800,000.

The special trains on the Siberian railroad certainly possess everything for the comfort of travelers. There is a library, piano, writing conveniences, barber shop, gymnasium, ice water, hot water, dials which indicate the next station and the length of the stop, double windows to protect the passengers from dust and the extreme Siberian cold, and an observation car at the rear. There is no charge for medical attendance, but baths cost one dollar. There are attendants on the train speaking English, French and German. The time from St. Petersburg to Irkutsk is seven days.

United States Consul-General Hunter, at Cairo, Egypt, sends to the State Department statistics of the Suez Canal traffic in 1899, which show that 3,480 steamers, of 9,893,022 tons aggregate, passed through the canal last year, as compared with a total of 3,464 vessels and 9,186,912 tons in 1898. Of the vessels passing through in 1899, 2,207, of an aggregate tonnage of 6,628,767 tons, were British; 378, of 1,051,149 tons, were German; 223, of 591,142 tons, were French; 205, of 438,175 tons, Dutch; and 102, of 255,281 tons, Austrian. Twenty steamers, of an aggregate tonnage of 64,801, flew the flag of the United States.

The British Navy are experimenting with two new varieties of fuel in place of Welsh steam coal. One is a mixture of anthracite coal with some other materials, the nature of which is not divulged, compressed into small blocks, and the other consists largely of Welsh coal residue. Four first-class battleships have shipped several hundred tons of this fuel. The reason for this action is probably due to the fact that the Admiralty sometimes experience great difficulty in obtaining sufficient quantities of the Welsh coal. A short time ago the stock of this coal at Portsmouth was exceptionally low and the question was raised in Parliament as to whether some other fuel could not be discovered that would fulfill the exigencies of the navy with equal satisfaction.

Mr. O. Guttman has recently made a series of experiments relating to the effect of explosions upon the surrounding air. It has been previously observed that as the air is greatly compressed under the circumstances, its temperature should be raised to a considerable degree; thus a compression of 200 atmospheres would cause an elevation of temperature of 1,060° C. As the explosives used in mines gives pressures of 6,000 to 8,000 atmospheres, the heat thus produced should be sufficient to inflame the gaseous mixtures found in the neighborhood. The experiments made by Mr. Guttman confirm this hypothesis: Two cartridges of an explosive containing ammonium nitrate were suspended near each other, and the explosion made, a photograph of the phenomenon being taken. The plate shows a luminous appearance at the meeting point of the two waves of explosion, and this may be attributed to the fact that at this point the compression caused the temperature to be raised high enough to inflame the surrounding gases.