

ance in considerable numbers around the wharves in New York city, and several of them have been caught with baited hooks.

Sharks have also made their appearance further up the Hudson River, above New York, and on the 15th of August, at Croton Point, 25 miles from this city, Mr. S. W. Underhill captured three of these monsters in a net that had been set for mossbunkers. One of the sharks measured 8 feet 9 inches in length, one 8 feet, and the other 7 feet 6 inches. In connection with these sharks a specimen of the remora was also taken, in length about 12 inches. Mr. Underhill kindly brought the fish to our office while it was alive. It exhibited its power of attaching itself by suction to the fullest extent, fastening itself to the sides of the vessel with great firmness. A remarkable peculiarity of this fish was its capabilities of changing color. When placed in the bottom of the pail and shaded from light its belly turned rapidly to a very dark slate color; but when the fish was brought up into the light, its belly quickly turned very white, like white paper.

The chief peculiarity of all these fish consists in an oval disk on the top of the head and the adjacent parts of the back, the surface of which is crossed by transverse cartilaginous plates, arranged somewhat like the slats of a Venetian blind; on the middle of the under surface are hook-like projections, connected by short bands with the skull and vertebrae, and their upper margin is beset with fine teeth. According to De Blainville, this organ is an anterior dorsal fin, whose rays are split and expanded horizontally on each side instead of standing erect in the usual way. By means of this apparatus, partly suction, partly prehensile by the hooks, the remora attaches itself to rocks, ships, floating timber, and the bodies of other fish, especially sharks, which it uses either for anchorage or for labor-saving transit.

TESTING FULL-SIZED BRIDGE COLUMNS.

A series of experiments has lately been made to determine the strength of wrought iron columns manufactured by the Phoenix (Pa.) Iron Company, and known as Phoenix columns. These tests were made in the Government machine at U. S. Arsenal, Watertown, Mass., and upon full sized columns of from 12 to 18½ inches sectional area of metal and from 8 inches to 28 feet in length. Twenty-two samples were submitted to ultimate compression strain. The elastic limit and deflection and the total compression are given in a table published by the American Society of Civil Engineers, from which it appears that they are stronger than theoretical formulæ heretofore used have made them; for example, a column 28 feet long, 8 inches diameter, or 40 diameters in length, having a sectional area of 12 inches, was compressed 0.19 of an inch under a load of 300,000 pounds, and gave way under 424,000 pounds, or 35,159 pounds per square inch of section. Another sample 25 feet long, of 18.3 inches sectional area, was compressed 0.115 inch under 300,000, and was crushed at a load of 659,000 pounds, or 33,010 pounds per square inch of section. The shortest sample, about one diameter in length, 11.9 square inches sectional area, showed only 0.008 of an inch compression at a load of 300,000 pounds, and was crushed at 680,000 pounds, or 57,130 pounds per square inch.

The loads sustained at various states of deflection were also observed and tabulated with the great care that characterizes the experiments made by Mr. James E. Howard, who has the handling of this splendid machine, the finest apparatus in this country. It is a new and important departure from old methods to test full-sized, complete members of engineering structures, in lieu of small samples of the material proposed for their construction, which was the only available way before this enormous machine was built by the United States Government. It is available for the use of manufacturers and others at a moderate per diem.

THE AMERICAN SCIENCE ASSOCIATION.

The opening of the annual session of the American Association for the Advancement of Science, at Cincinnati, was noticed last week. The secretary announced at its close that in attendance the meeting had been the most successful one ever held, with the single exception of the Boston meeting last year. More new members were received this year than ever before. The association now numbers two thousand members. The officers for the meeting next year, to be held at Montreal, beginning August 23, are as follows:

President.—Dr. J. W. Dawson, of Montreal, Canada.

Treasurer.—William T. Vaux, of Philadelphia.

General Secretary.—William Saunders, of London, Ohio.

Assistant General Secretary.—Prof. J. Eastman, of Washington.

The Permanent Secretary having been elected for five years, Prof. Putnam, of Cambridge, the present incumbent, will continue in office.

Vice Presidents and Chairmen.—Section A.—Prof. William Harkness; Section B.—Prof. T. C. Menhall, of Columbus, Ohio; Section C.—Prof. H. Campbell Bolton; Section D.—Prof. W. P. Trowbridge; Section E.—Prof. E. T. Cox, San Francisco, Cal.; Section F.—Prof. W. H. Dow; Section G.—Prof. A. H. Tuttle, of Columbus, Ohio; Section H.—Prof. Daniel Wilson, of Toronto; Section I.—Prof. E. P. Elliott.

Secretaries.—Section A.—Prof. H. T. Eddy, of Cincinnati; Section B.—Prof. Charles T. Hastings, of Baltimore; Section C.—Dr. Alfred Springer, of Cincinnati, Ohio; Section D.—Prof. Charles B. Dudley; Section E.—Capt. C. E. Dutton; Section F.—Dr. Charles Minot, of Boston, Mass; Sec-

tion G.—Prof. Robert Brown; Section H.—Prof. Otis T. Mason; Section I.—Franklin T. Hough, of Lowville, N. Y.

Sixty-eight professors of science, directors of museums, army and navy officers, members of the Coast Surveys, chemists, etc., from all parts of the United States, were recommended by the Standing Committee for the honorary degree of "Fellows," and were elected by ballot.

The work done at Cincinnati, both in general sessions and in the several sections, was of considerable general as well as scientific interest. One of the earlier resolutions adopted was a hearty protest against the too common practice among colleges of conferring the degree of Doctor of Philosophy *honoris causa*. Provision was made for the reprinting of several volumes of the Transactions of the Association. A new committee, consisting of Prof. G. C. Swallow, of Missouri; Prof. Proctor, of Kentucky; Prof. James Hull, of New York; Prof. Winchell, of Missouri; Prof. Kerr, of North Carolina; Prof. Orton, of Ohio; Major Powell, of Washington, was appointed to plan and recommend a systematic and more accurate method of making State geological surveys.

The report that the geologists were disposed to withdraw from the association and set up a separate organization was denied by Prof. Swallow, who said that, though the geologists had organized the association, all they wished now was that there be a reorganization of some of the sections, and that a geological library be established, in which a record of all the geological discoveries and all the geological specimens be kept. A geologist could then know when he had made a new discovery, or whether or not a new specimen which he had in his possession had already been described. More than a hundred papers were read at length or by title in the several sections.

STEAM-BOILER NOTES.

The deterioration of the strength of boiler plates over the fire from exposure to intense heat, while defective conditions exist inside, either from imperfect circulation, the nascent steam not being swept off by the motion of the water, or from the accumulation of deposits or incrustation incident also to bad circulation, often causes bagging down of the plates, which, although apparently in contact with the boiler water, become practically overheated.

The same effect is sometimes produced by the use of blowers to urge the fire, particularly if clinkers are formed in the fire, which prevent the free passage of the air throughout the whole grate area. The blast passing through holes concentrates in a number of jets, which impinge on limited areas with increased local effect, and the intense heat not being transmitted with sufficient rapidity, the exposed surface of the metal becomes surcharged with heat and either softened or oxidized in detail, as the holes form in new places after trimming the fire. The effect is undue expansion or softening and stretching of the fire surface of the plate and bagging from internal pressure.

I. R. B. & Co. write for advice in the matter of their new steel tubular boiler, which has given trouble from bagging of the plates over the fire after only one week's use. We gather from their correspondence and that of the maker of the boiler, who thinks his work has not been fairly treated, that the boiler shell is made of Cleveland steel (thickness not given), is 48 inches diameter, 14 feet long, with 34 flues 4 inches diameter, spaced about ¾ inch to 1 inch apart, the lower row of flues being 8 inches from the bottom and 4½ inches from the sides of the shell. It is set 20 inches above the fire grates, and is used night and day, burning 180 pounds of coal (kind not given, nor area of grate).

At the end of about a week's use the plates over the fire were found bagged down about 1½ inches. The distorted plates were replaced by new ones, which began slowly to come down in the same way, and when about half as bad as the first ones the lower row of flues was taken out and the holes plugged, which seems to have stopped the difficulty. In answer to an inquiry as to the safety of the boiler we advised them to apply two braces to the boiler heads, unless they were of unusual thickness, the shell itself being, of course, safer and more efficient than it was before the flues were taken out, because of more perfect circulation of a larger body of water within the boiler.

By the removal of the lower row of flues the unsupported area of the heads below the flues may have been fully doubled, and the tendency of the pressure (which is not given) upon the part of the head will be to cause undue tension on the lower side of the flues, especially the middle ones, by the slight outward motion of the head. While this prying strain exists the under side of the flues is liable to corrosion on account of the direct action of the water on the minute particles of the metal that are exposed by the strain. When once this action commences it goes on in an increasing ratio as the wasted part gets weaker, and it may not show itself till too late to prevent an explosion. The four plugged holes take 16 inches out of the head in a horizontal line passing through their centers. A pair of braces for each head were, therefore, recommended for the prevention of this possible event. Twenty inches depth of furnace is not sufficient for bituminous coal, especially if the bridge wall is high and no air is admitted at the back of the furnace to complete the combustion. A high bridge materially affects the distribution of the heat over the lower plates of the boiler, and if our correspondents have such they would realize increased economy as well as safety by cutting it down and lowering the grates.

The boiler of the tug A. B. Ward exploded August 20, at

Chicago, while the boat was in the river. The captain, Frank Butler, was hurled into the air and fell, fatally mangled but alive, upon the deck of a barge that the tug had in tow. William McDonald, a deck hand, and Ole Oleson, are missing. They are supposed to have been killed. Michael McDonald, the fireman, and Frederick Whitaker, the cook, were slightly injured.

The cause of the explosion is unknown, though in the opinion of Stewart H. Moore, United States Inspector of Boilers, the disaster was due to low water, as the iron of the boiler shows signs of having been red hot. Inspector Moore states the boiler was built in 1877, and was inspected April 29 last and found to be in excellent condition, withstanding a hydrostatic pressure of 165 pounds, or 55 pounds more than the required maximum. It was of three-eighths boiler iron, which appears to be of good quality.

A Remarkable Explosion and Fire Caused by Lightning.

The city of St. Louis, Mo., has an almost world-wide reputation for the excellence of its flour. The other day (August 12) one of its large flouring mills, which was also one of the oldest institutions of the kind in the West, was utterly destroyed by lightning, explosion, and fire, occurring in the order named, and so rapid was the course of the disaster that the workmen could not all escape from the burning and falling building. Four were killed and six others seriously injured.

The Atlantic Flouring Mills, the establishment referred to, were built 35 years ago on Main and Plum streets, occupying, according to the St. Louis *Miller*, 140 feet on the former by 125 feet on the latter, and five stories in height. A lightning stroke on the evening of the day above named ignited the mill dust in the upper part of the building, causing an explosion, which split the walls to their foundations, and immediately the whole took fire and is said to have been consumed in about half an hour. The mills were not long since supplied with the latest improvements in milling machinery. The property destroyed was valued at \$325,000.

The enterprise and resources of the proprietors are indicated by the promptness with which they supplied themselves, probably at great expense, with other mills as a temporary substitute for the demolished ones, wherewith to meet their business engagements, and also by the vigor with which they have set about rebuilding on a scale equal to if not greater than that of any flouring mills in the United States.

According to their circular issued to their patrons, the new mills will occupy a block 274 feet by 165 feet, and be connected with several railroad trunk lines, filled with the very latest improved machinery, and turn out flour of the best quality.

Inventors have an opportunity now to study out new safeguards against disasters such as we have described, either by preventing the escape of the light, impalpable dust from the conveyers, bolting chests, coolers, and packers, or to treat the dust with steam or humid air in the top of the mill, so as to render it incombustible. Fireproof metal casings and conduits may also be practicable and useful as preventives of the spread of fire.

The Retreating Comet C.

At this writing (August 24) Schaeberle's comet has passed its period of greatest brilliancy. As it is now rapidly retreating into space it is evident that it must rank far below comet B as an object of popular interest. For several nights it has presented a fairly conspicuous object in the northern sky, directly under Ursa Major, and, though accounted by astronomers twenty-five times brighter than when it first appeared, it bears no comparison with the comet of 1861, which it was expected to rival. Under a low magnifying power the nucleus appears simple and surrounded by a sharply defined sphere of light. The tail is short and brush-like. The comet was nearest the earth August 20. The weather has not been favorable for photographic or spectroscopic observation.

Instinct or Reason?

A short time ago a fine specimen of a water spaniel gave birth to a litter of five healthy pups at No. 813 Hempstead street, and a few days afterward a servant kidnapped two of them. At first the mother did not seem to display any feeling of regret, but it soon became apparent that the supply of milk was intended for five instead of three mouths. This fact became so patent to the mother that she sought for a remedy, and discovered it in the shape of two kittens, which she boldly took from their quarters under a lumber pile in the same yard. These two adopted children were placed with their stepbrothers and sisters, and were fed by their new guardian or stepmother. She could not have mistaken them for her offspring, inasmuch as she knew of their existence before her babies were taken from her, and saw them daily. She could have taken the kittens before had she thought they were part of her family, but it was only when she was obliged to find relief for her breasts that she resorted to the tactics mentioned.—*Missouri Republican*.

The Coast Survey.

Professor Julius E. Hilgard, for twenty years assistant in charge of the office, has been placed in temporary charge of the Coast and Geodetic Survey. It is understood that he will be appointed superintendent to succeed the late Captain Carlile P. Patterson.

Give the Baby a Drink of Water.

A city physician attributes a large part of the excessive mortality of children in hot weather to the failure of nurses and mothers to give them water; indeed more children are said to die (directly and indirectly) from deprivation of water than from any other cause. Infants, he says, are always too much wrapped up, and in any case would perspire very freely. The water lost by perspiration must be supplied. As Dr. Murdoch stated in his paper on cholera infantum, "The child is thirsty, not hungry; but not getting the water, which it does want, it drinks the milk, which it does not want." The consequence is that the stomach is overloaded with food which it cannot digest, and which soon ferments and becomes a source of severe irritation. Then follow vomiting, purging, and cholera infantum."

To prevent this, the principal scourge of infancy, the doctor says: "Have water—without ice—always accessible to the child, who will then refuse sour milk and will eat only when hungry. Water is the great indispensable article for the preventive treatment of children in hot weather. It is important enough to nursing children, but is life itself to those reared on the bottle."

THE PARIS ELECTRICAL EXHIBITION.

[Continued from first page.]

Two, five, ten, and twenty light machines are used in the Exhibition to light the grand aisle and other halls on the first floor. The machines are exhibited by Messrs. Sautier, Lemonnier & Co., owners of the new Gramme patents in France; also by the Spanish Electrical Society and by the Gramme Company. The Gramme Company make four sizes of machine. No. 1, for 1 to 2 lamps; No. 2, for 2 to 3 lamps; No. 3, for 6 to 8 lamps; No. 4, for 12 to 16 lamps. Nos. 3 and 4 have not been experimented with as yet, but it is thought they will excel Nos. 1 and 2.

The Weston dynamo machine exhibited differs only slightly from those already described in our columns. It will be observed by reference to the engraving that the field magnet is compound, being composed of a number of electromagnets with cylindrical cores.

The Siemens steam dynamo used in connection with the electric railway is well represented by our engraving. The generator and steam motor are mounted on a common base, the motor being a rotary steam engine.

The car shown in Fig. 5 does not differ materially in appearance from an ordinary street car. The electric motor placed under the car floor is entirely inclosed. It receives its current from the rails, and the power is transferred to the car axles by means of pulleys and belts.

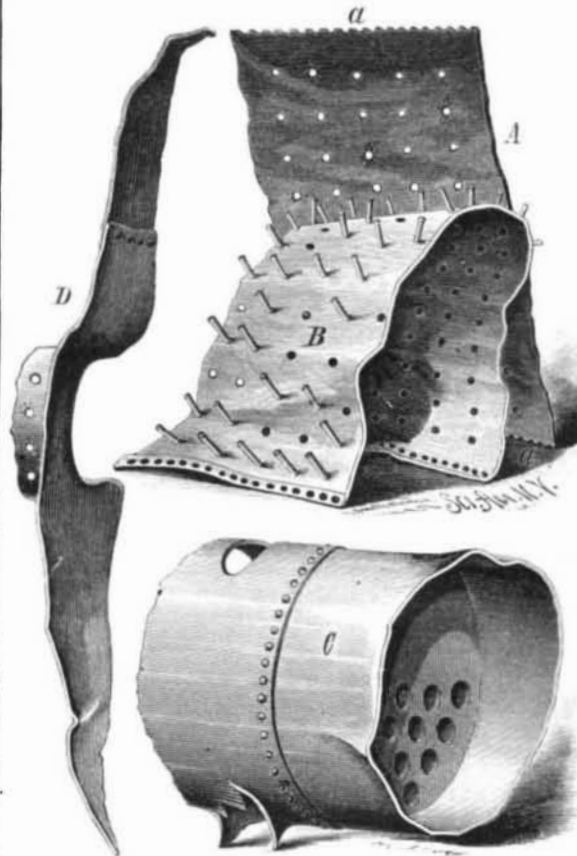
Other important exhibits in the various departments will be described in later issues. About one-third of the 1,800 exhibitors are from countries other than France. A list of the American exhibitors appears below. Many of them are represented in two or more classes. The Edison exhibits are naturally attracting much interest. They appear in each of the six general groups of exhibits, and represent fifteen different classes. They are shown in two salons, which contain a complete illustration of the Edison system of incandescent lighting, as well as representations of all his inventions and discoveries. It is remarkable that the labors of a single investigator and inventor should cover a field as broad almost as the entire scope of an international exhibition.

On the 25th of August an electrical fire broke out in the reading room of the Exhibition. It was occasioned by a defect in the fitting up of some incandescent lamps. The alarm was quickly given and the fire was extinguished before it had spread far. In attempting to tear out the wires with his hands a fireman received electrical shocks and was twice knocked down. A scientific commission, headed by MM. Dumoncel and Breguet, afterward made an examination of the connections of the various exhibitors, and there is now no further danger to be feared.

PARIS ELECTRICAL EXHIBITION OF 1881—LIST OF AMERICAN EXHIBITORS.

Thos. A. Edison, Menlo Park, New Jersey.
J. Morgan Eldredge, Philadelphia, Pa.
Electro-Dynamic Company, Philadelphia.
August Partz, Philadelphia.
Theodore Schmanser, Allegheny City, Pa.
U. S. Signal Office, Washington, D. C.
Joseph M. Hirsch, Chicago, Ill.
Milo G. Kellogg, Chicago, Ill.
Standard Electric Light Co., New York.
U. S. Electric Light Co., New York.

Weston Electric Light Co., Newark, N. J.
White House Mills, Hoosac, N. Y.
Wilson P. Dodson, Philadelphia.
Alex. H. Ege, Mechanicsburg, Pa.
Hoosac Tunnel Trinitro-glycerine Works, North Adams, Mass.
William J. Philips, Philadelphia, Pa.
J. F. Bailey.
Alex. Graham Bell, Washington, D. C.



WATERTOWN BOILER EXPLOSION.

Sumner Tainter, Washington, D. C.
Charles Williams, Jr., Boston, Mass.
Conolly Bros. & McTighe, Washington.
George Cumming, New York.
Electrographic Manufacturing Co., New York.
Elisha Gray, Highland Park, Ill.
Pond Indicator Co., New York.
Chas. W. Hubbard, Boston, Mass.
A. E. Dolbear, Somerville, Mass.
E. W. Serrell, Jr., New York.
Clinton M. Bell, Troy, N. Y.
Photo-relievo Co., New York.

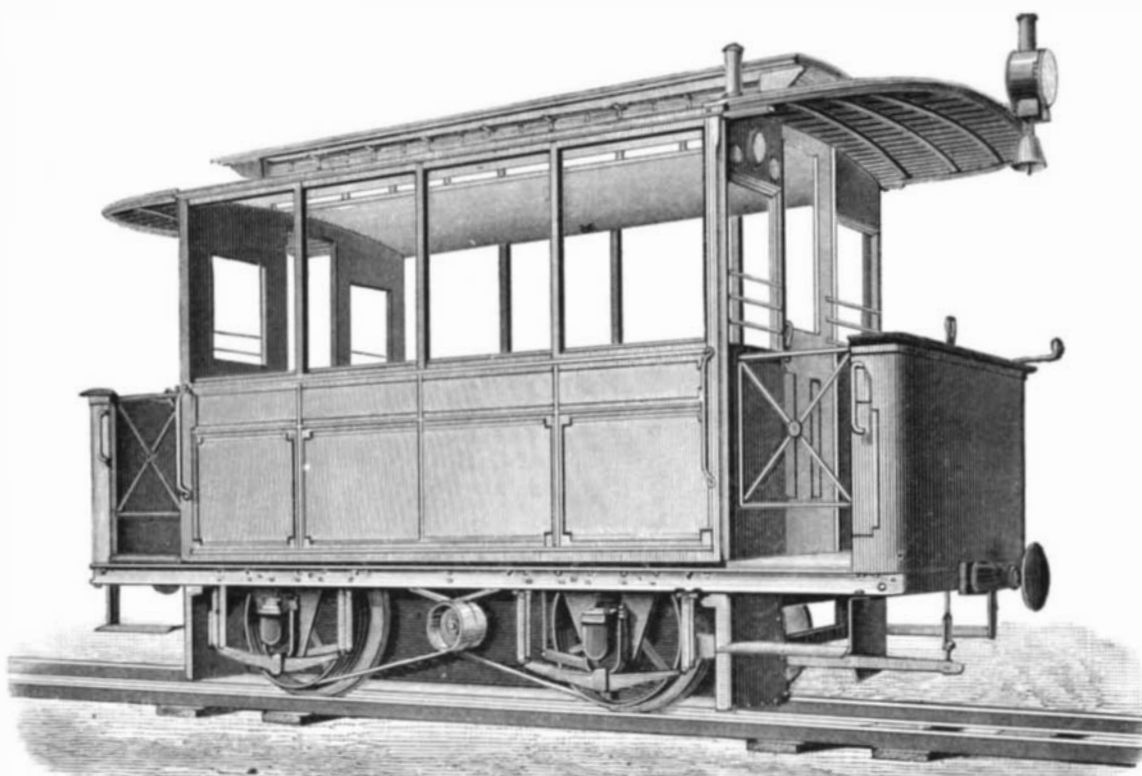


Fig. 5.—ELECTRO-MOTOR CAR ON THE ELECTRIC RAILROAD AT GROSS-LICHTERFELDE.

W. G. A. Bonwill, Philadelphia.
Electric Purifier Co., New York.
Robert Hasse, Indianapolis, Ind.
Volney W. Mason, Providence, R. I.
U. S. Patent Office, Washington.
John Michels, New York.
Smithsonian Institution, Washington.

Charred Bran for Preserving Fruit.

The use of charred bran for preserving delicate fruit while on the road to market, bids fair to solve the problem which has so long perplexed our millers. Converted into charcoal, the light and slippery product of the mills ceases to be unmanageable; and it is quite likely that a large local

demand for charred bran will arise in the vicinity of most mills, for packing not only quickly perishable fruits like peaches, plums, and grapes, but also apples and other firmer fruits, for storage as well as for transportation.

WATERTOWN BOILER EXPLOSION.

To the Editor of the Scientific American:

I went to examine the boiler lately exploded near Watertown, this county, by which three lives were lost. The fragments of the exploded boiler show the terrible nature of the force at work in this explosion. It is a difficult matter to learn any particulars as to the cause which might lead to the explosion of this boiler, as no one who knows much about it now lives. As to whether the water was low or not we do not know. The mill had been idle for some time, and the engineer wanted to clean out this boiler before starting up, but the owners said no, "Go ahead and fire up." He did so, and in the afternoon the explosion occurred, probably about eight hours after starting. There was no coroner's inquest, consequently there is no evidence to give as to the previous condition of the boiler.

In my examination of the remains of the boiler I find that the stay bolts were eight inches from center to center, and a large number of the bolts remain in the fire box sheets yet, showing that the outside or shell of the box tore loose, and the piece represented at A is the shell of the fire box, which also goes to form the top of the boiler. The edges, a a', were respectively riveted to the bottom of the legs of the fire box, and gave way through the rivets along this edge and opened up and straightened out flat, as shown in the cut. This piece was found 150 feet or more from its starting point. It went up about 30 feet, and struck and cut off a gum tree about a foot in diameter. A large number of the stay bolt holes show that at some past time there has been sufficient strain on them to start them, as the holes show cracks radiating from the circumference; but these cracks do not go through the sheet, consequently they would indicate nothing on the outside except a small indentation around the head of bolts. The flues were all torn out, and the fire-box, B, was smashed into a shape somewhat resembling a hat if taken by both hands and smashed together.

One piece of the boiler, C, including the front flue sheet, remains but little injured. One piece, D, immediately in front of the fire-box and forming part of the front leg of boiler, is in a curious shape. It is about 10 feet long and 2 feet wide at its widest place, but each end runs off to a point. The crown sheet shows no indication of excessive heat, as the stay bolts are yet in it, which would not have been the case if the sheet had been left bare of water.

As near as I can get at the cause of this explosion I am led to believe that it was caused by an insufficient number of stay bolts, and that the explosion took place in the fire-box end of the boiler, the shell of the fire-box blowing up away from the fire-box, and at the same time the firebox was smashed in and the other parts of the boiler were torn to pieces.

The boiler was of the common type of portable boilers, with fire-box at one end, and it seems to me criminal carelessness on the part of the builders to construct a boiler with stays eight inches apart, and there should be some way to prevent this careless way of constructing boilers. The iron seems to be of fair quality, but shows laminated edges in some of the fractured pieces, showing that it is not of the best quality.

I have frequently examined this kind of a boiler after explosions, and have invariably noticed this laminated appearance; and in this particular case I noticed that where the stay bolts had partly pulled out or started to pull out at some past time, the cracks around the holes passed only through the inside layer of the boiler plate. This fact leads me to believe that explosions occur frequently from this laminated condition of the plates or imperfect weld of the plate in manufacture.

Marietta, O., July 30, 1881.

WM. M. MORSE.

The Great Heat of the Sun.

Prof. S. P. Langley has made the following calculation: A sunbeam one centimeter in section is found in the clear sky of the Alleghany Mountains to bring to the earth in one minute enough heat to warm one gramme of water by 1° C. It would, therefore, if concentrated upon a film of water 1-500th of a millimeter thick, 1 millimeter wide, and 10 millimeters long, raise it 83½° in one second, provided all the heat could be maintained. And since the specific heat of platinum is only 0.0032, a strip of platinum of the same dimensions would, on a similar supposition, be warmed in one second to 2,603° C.—a temperature sufficient to melt it!