Yacht Squadron regatta, open to all nations, beating," after which follow the names of all the vessels which started in the race. On the next medallion is engraved, "Schooner America, 170 tons, Commodore John C. Stevens; built by George Steers, New York, 1851." On the other spaces are inscriptions recording the results of the races with the schooners Cambria, Livonia, and Countess of Dufferin, and the sloop Atalanta.

The programme for the races was as follows: Sept. 7, outside Sandy Hook, twenty miles to windward and return; Sept. 9, over the regular New York Club course, when, if a third race should become necessary to decide the contest, it was to be sailed over a forty mile triangular course outside Sandy Hook.

A Good Suggestion.

In giving estimates, says one of our contemporaries, do not make your calculations on loose scraps of paper and then throw them away, keeping only a memorandum of the amount. You may want to look over your figures some day, and verify the operations that gave them to you. Have a blankbook, and arrange an index for it; then make as many divisions or departments as the different classes of your work require, and be careful to observe the arrangement in your use of the book. Make all your calculations in this, compactly, make a note of number of the page in the index for easy reference, and the book will become more valuable to you every day.

The Longest Single Span Girder.

The new railroad bridge over the Ohio between Evansville, Ind., and Henderson, Ky., which was formally opened for traffic in the early part of August, enjoys the distinction of having the longest single span girder of any bridge yet constructed. It is built on the triangular truss plan, and is very symmetrical and pleasing in appearance. The structure has a length of 3,200 feet, and rests on sixteen piers, each span being 250 feet long, with the exception of the one over the main channel. This is 525 feet, and is, we believe, the longest single girder in the world. It is 103½ feet above low water, and 57 feet above high water mark. The bridge, with the lines connecting the railroad system centering at Evansville with the Louisville and Nashville system at Henderson, has a length of ten miles, three miles of the approach on the Indiana side being over a wooden trestle.

The bridge at Cincinnati, built several years ago, has a clear span of 515 feet, and was at the time of building the longest railway girder known. Next in length came the Kinlenburg Bridge in Holland, with a span of 492 feet. It is not probable that the Henderson Bridge will long enjoy its distinction, for the limits in this direction have already increased so surprisingly that spans of 800 feet, such as the central span of the contemplated bridge over the Hudson at Poughkeepsie, N. Y., are not considered impracticable; but 525 feet has not yet, we believe, been exceeded, except on paper.

The Effects of Lightning Stroke.

At a recent meeting of the Berlin "Verein fur Innere Medicin," Dr. Liman described the changes present in the bodies of two men who had been killed by lightning when taking shelter under the trees of the Thiergarten. In the one subject the hair over the left temple was singed, and the skin from the left ear to the shoulder-blade was discolored a brownish-red, the chest and abdomen being covered with red and white streaks. Reference was made to the dendritic figures described in many cases, and attributed often to impressions of twigs, leaves, etc., and in this body there was a figure which could be compared to a palm leaf, but which was undoubtedly due to the contact of the folds of the shirt. The parts thus pressed upon remained white, the surrounding skin being reddened. The apex of the heart was the seat of an irregular cavity, which communicated with both ventricles; evidently the lightning stroke had caused rupture of the organ. In the other case the skin and hair were similarly excoriated and singed, and numerous ecchymoses occurred beneath the serous layers of the pericardium and pleura; the lungs were much congested. Here death was evidently due to asphyxia. Dr. Liman mentioned, and Professor Leyden confirmed the fact, that death by lightning is occasionally accompanied by rupture of internal organs, as the brain and liver.

Decision in Regard to Patent Harrows.

Justice Stanley Matthews has decided in favor of the plaintiffs in the now celebrated case of D. C. and H. C. Reed and Co., patentees of the spring tooth harrow, *vs.* Chase, Taylor & Co. *et al.*, for infringement of patent, which was tried in the United States Court at Grand Rapids, Mich. The case has been before the courts for several years, and involved the past fifteen years' business in spring tooth flat harrows. By this decision the patentees will enjoy a royalty from every farmer or concern making any kind of infringement. It is one of the most important cases ever decided in patent litigation.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 12, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 506,

For the Week Ending September 12, 1885.

Price 10 cents. For sale by all newsdealers.

NEW YORK CABLE ROAD.

New York is now about to have its experience with a surface cable road, and having been a little behind other cities in this respect, it starts out with the advantage of their blunders as a warning.

The Third Avenue Railroad Company has completed its cable line on Tenth Avenue from 125th to 186th Street, and formally opened it to the public on the 29th of August. The constructing engineer, Mr. D. J. Miller, was an assistant on the Chicago Cable Railway, and his experience there suggested several novel features for the New York road. The objection that has always been urged against cable roads in general is on the ground that should any accident happen the cable, the entire road would be disabled. The fear of such an event has induced a feeling that the system is not altogether reliable.

More specific objections are due to the fact that often they work anything but satisfactorily, and are not always subject to that immediate control which should be an absolute requisite on any road passing through crowded thoroughfares. These, however, are objections which, though serious enough, as our experience in Philadelphia and Chicago has shown, are not essential to the system, and by a more perfect working out of the details are quite remediable.

The Tenth Avenue Road has therefore removed the essential fault of the system by providing for the contingency of a broken cable. Throughout its entire length, the road is constructed with a double cable. Both are contained in the same tube, so that in case of accident to one, it will be a matter of but a few minutes to put the other in operation, and so avoid any serious delays of travel. The road contains several heavy grades, and is a trifle over three miles in length. It is expected that the route will very shortly be extended across the city on 125th Street. The cable is of iron, 1¼ inches in diameter, and is 33,100 feet long, or about 6¼ miles. It weighed on the reel 46 tons.

The motive power plant is located at 128th Street and Tenth Avenue, where a handsome building of iron and moulded brick, 100 by 200 feet, has been erected, and furnishes ample and well arranged accommodation. The engines and cable gearing are placed in the basement. The two large engines, built by Mr. Wm. Wright, of Newburg, are each of 350 horse power, and are capable of operating both cables, so that ordinarily but one will be in use, and the reserved power will be an additional safeguard against delay or accident. These are supplemented by two donkey engines of 75 horse power each, which would be able to keep the cables moving, but at a reduced rate of speed. The entire building is lighted by an installation of Edison lamps. A No. 8 dynamo, of 3,200 candle power, and making 1,400 revolutions per minute, furnishes the necessary current. As such extravagant claims are put forward by various electric companies for their respective systems, the statement of the contractor may not be uninteresting, that the system introduced was giving 100 candle power for every horse power consumed. The lamps in use were 16 and 10 candle power, and 6¼ and 10 lamps respectively were therefore maintained by each horse power.

A considerable speed is claimed for the new road. The round trip of 6¼ miles, it is stated, can be made in 40 minutes. This, of course, is making no allowance for stoppages, but a moderate estimate for these delays would still leave a fair speed for surface travel.

SUBMARINE WARFARE.

The probability that the not distant future will see the perfection of the submarine torpedo boat and ram furnishes still another argument against the construction of great forts for harbor defense. If the marine monster now being completed at Fort Lafayette will do the half that is claimed for it, it would not be safe for the heaviest armed and armored ship afloat to lie at anchor or attempt to maneuver in its vicinity; for it must deal with an unseen enemy which guns cannot reach nor armed men overpower. Should this vessel prove a success, the art of defense may reasonably be looked upon as having outstripped the art of attack, and we can look back upon our dilatoriness in building harbor defenses with something like complaisance. Nor should it be forgotten, if this submarine vessel proves successful, that the success is in great part due to electricity and to the recent improvements in the storage battery and the electric light. The Holland submarine vessel proved that compressed air is both dangerous and uncertain when used under the conditions present in a submarine construction. It may be used as an auxiliary, but is not suitable for a main dependence. The secondary battery or the primary battery is, on the other hand, of certain action, and may therefore safely be depended upon to supply not only power, but also light. The testimony of divers proves that the electric light will illumine great distances under water. In a fog it shows itself lacking in the red and yellow tints which make gas and oil so effective, but beneath the surface of salt water, it seems, the powerful white and blue rays serve admirably to pierce the dim and somber-hued depths.

Few people are aware of how much power the se

condary battery is capable of giving out under favorable conditions. When we set aside the question of cost—and such questions do not rise in the construction and operation of war material—sufficient power in the shape of electrical energy can readily be had to move a submarine vessel, and indeed to keep it moving for many hours. In such a vessel as that at Fort Lafayette, two complete and separate power batteries could be kept side by side in the hull, and when one is exhausted, the other could be turned on by simply moving a switch. So, too, with the lights; and when it is remembered that nine incandescence lights can be generated by expending one horse power per hour, it is readily seen that all the light required could be had for a mere song. The incandescence light, too, is particularly fitted for submarine work or navigation, because, since there is no combustion, no air is required. Being *in vacuo*, it does not in any way affect the air save to throw off a small modicum of heat, whereas the voltaic arc light requires a constant supply of air.

The plan of operating this unique vessel is to drop below the surface at long range after the compass course has been ascertained. The strength of the currents being known, the leeway is reckoned by dead reckoning, and the monster brought within range of the enemy's hull. Then comes the attack.

A HEAVY GUN THAT WILL NOT BURST.

Lying snugly housed near the point of Sandy Hook is a great gun, nearly thirty feet long. It has been there for some time, and is an object of curiosity to all who visit the neighborhood. This gun was designed in part by Mr. George Edgar, and is his property. Many thousands of dollars have been spent upon its construction and exhibition, but though a military committee reported favorably upon it, no steps were taken by the Government toward purchasing the patents taken out by its constructors. The claims made for the gun refer exclusively to the breech, which is said to possess no little novelty and merit.

Not long ago Mr. Edgar visited Washington on business connected with this gun. He was accompanied by an American mechanician and designer of guns, now employed by the Russian Government to conduct their great gun works on the Neva. After a somewhat unsatisfactory visit to the War Department, the two were sitting in the cafe of the Ebbitt House, discussing the chances of the adoption of the principle of the big gun by the military authorities.

"They tell me," said Mr. Edgar, "that what they want is a gun that won't explode; when they get such a one, they say they expect to have no trouble in finding an easy working and efficient breech mechanism."

"Yes," replied his companion, "that's what they are looking for all over the world."

The two men sat silent for some time.

Finally, Mr. Edgar, in crossing his legs, kicked off the cover from an India rubber cuspidor. Like most of these contrivances, this cover was made of hard rubber with beveled edges, the sides as they sloped toward the hole in the center having a fall or decline of about 30° from a plane.

Mr. Edgar observed this cover intently as it rolled and gyrated about the marble floor.

Before it came to a dead stop he seized it with something like precipitation, and with sparkling eyes exclaimed to his companion, "I've got it!"

"Got what?" asked the latter languidly.

"I've got the principle on which the non-bursting gun can be constructed."

"Bah!"

Not heeding this expression of incredulity on the part of his friend, a man, too, of great skill in metal working, Mr. Edgar gave such forcible reasons for believing a non-bursting gun could be constructed of a series of plates similar in form to the top of a rubber cuspidor, that he was compelled to admit that there was something in the idea.

Returning to New York city, Mr. Edgar at once set to work to make a gun on the plan suggested by the incident in the Ebbitt House cafe.

This experimental gun is four feet long, and composed throughout its whole extent of corrugated plates of Russian iron. At its completion, he took it up to West Point, which, he had been told in Washington, was one of the Government testing points for guns.

On his arrival at the works, and mentioning the fact that he had a new gun with him, he was told that the number of new guns constantly appearing was legion. "The trouble with all of them," said the officer, "is that they burst too readily. What kind of a test do you want us to put your gun to?" he added.

"Why," replied Mr. Edgar, "I would like to have you burst it."

"Certainly," said the officer, with something like sarcasm in his voice. "We're always glad to accommodate gentlemen with new guns."

The gun was now taken behind a hill, a double charge of powder introduced, and fired with a time fuse. It turned two or three back somersaults, but remained intact. It was now loaded with a quadruple charge, and fired, the only effect being to multiply the number of the back somersaults.

"This is very good indeed," said the officer. "I'm sorry to keep you waiting so long. I'll now load it up to the muzzle, and that will be the last of it." Fired under these conditions, it rose in the air, whirled around for a few moments, and then came down and buried itself in the earth. After being dug up it was charged nearly up to the muzzle with powder and wad, and then spiked. The only result was that it rose higher in the air than before, spun around more rapidly, and buried itself still deeper in the ground when it came down. It had not even been chipped!

"Is there anything else you'd like to put into it?" demanded Mr. Edgar, it being now his turn to be ironical.

"No!" was the reply; "it beats me." Having thus stumped the gun testing authorities, Mr. Edgar brought his little gun back to New York in triumph.

THE DECLINE OF THE SAILOR.

It is not so long ago that the test of a sailor's qualifications as a man-of-war's man was the expertness with which he could hand, reef, and steer. He was given a trial aloft and alow, and then rated as a first-class seaman, ordinary seaman, or landsman and lubber. All this is being rapidly changed by the appearance on the ocean of complicated collections of machinery protected with heavy armor and called modern warships. When they engage the enemy, it is an artillery duel or pounding match at long range, and the lusty calls to prepare to receive boarders or for the pikemen to advance are never heard. The trumpet no longer calls aloft to the nimble topmen, for scarce a sail remains. There is no running in and out of guns. When they are moved or loaded, it is by machinery. This is indeed a sad day for Jack. The man who coils rope against the sun, and regards the bowsprit as a prolongation of the keelson, is on the same plane with him. The captains of the tops now stand their watches in the machine shop or stoke hole, and the ship's yeoman is set to stir the duff pudding. It is bad enough to have to navigate the seas in a teapot, as Jack calls the steamer, but now there is a tendency to build submarine warships, and this will drain Jack's cup of sorrows to the lees.

In the old days naval officers were expert navigators and nothing more, and their crews were sailors. To-day the officers must be scientists and the men mechanics.

ASTRONOMICAL NOTES.

THE COMET OF 1858,

or Tuttle's comet, which has been expected for a year, was first seen at Nice, France, on the 10th of August. The news was quickly sent by cable message from Kiel, Prussia, to Harvard College Observatory, and as quickly reported by telegraph through the United States. This comet was first discovered by Mechain at Paris, on the 28th of January, 1790. Its periodicity, however, was not established until after its second discovery by Tuttle of the Harvard College Observatory, on the 4th of January, 1858. The period was determined to be 13·78 years, and it passed its perihelion on the 23d of February, 1858. It made its first recorded return on time, being first seen at that return by Borelly at Marseilles, on the 12th of October, 1871, passing its perihelion on the 2d of December of the same year. The reappearance of this comet at the present time was confidently expected, and observers were instructed to make a close examination of the northeastern heavens during the absence of the moon in August just before morning twilight.

The search was successful, and the erratic visitor was picked up safe and sound, after its long journey of nearly fourteen years. It will reach perihelion about the 11th of September, and will therefore rank as the third comet, or comet *e* of 1885. Encke's comet, having passed its perihelion in March, stands on the records as comet *a*, and Barnard's comet takes its place as comet *b*. The comet's place when found was in Gemini, and it rose about 2 o'clock in the morning. Its distance from the earth was 1·91 in terms of the earth's mean distance from the sun. The distance is diminishing and the brightness should be increasing, but is not up to the standard of its first aspect when seen in 1871.

BARNARD'S COMET,

or comet *a*, has been extensively observed in Europe. It was seen at Kiel on the 10th of July; at Arcetri (Florence), Vienna, and Strasbourg on the 11th of July; and at Rome and Palermo on the 12th of July. It is receding from the earth, and becoming gradually fainter. Its perihelion passage takes place on the 25th of September, when the comet's distance from the sun will be 2·295 in terms of the earth's mean distance. The comet seems to possess little to commend it to notice, its only claim being that thus far it is the only cometic prize of the year. The other two comets are old friends, returning to make their periodical visits.

ASTEROIDS.

Professor Peters, of Clinton, has added to the laurels he has already won in the same department of investigation, by discovering on the 16th of August an asteroid of the 12th magnitude, which takes rank as No. 249. The newcomer has not yet been honored with a name.

Dr. Palisa, of Vienna, has increased his voluminous record in the same department by the discovery of asteroid No. 248, and named it Lameia. The two latest comers of this rapidly increasing family were preceded since the year commenced by the advent of three others, five asteroids having thus far been picked up in 1885. The year is neither fertile in asteroids nor comets, but none may foretell what wonders the remaining three months of the year may produce.

PHOTOGRAPHS OF THE ORION NEBULA.

The late Professor Henry Draper was the first to succeed in obtaining a successful photograph of the famous nebula in Orion. Mr. Common, an English astronomer, is interested in the same field of work. He exhibited, at a recent meeting of the British Astronomical Society, a series of enlargements of photographs of the Orion nebula, taken with different exposures varying from a few minutes up to sixty minutes. With the longer exposures, the outer and fainter portions of the nebula were shown, but the inner and brighter portions were obscured by over-exposure. It was only by a combination of such pictures that the whole of the details visible in the nebula could be studied. With the longer exposures, regions of the nebula invisible to the eye with the telescope register themselves on the photographic plate. Mr. Common had obtained, with an exposure of sixty minutes, traces of many stars invisible to the eye. He had not at present tested what could be obtained by still longer exposure. Reliable photographs of the present condition of this wonder of the skies will be an inestimable gift to the astronomers of the future.

Meeting of the American Association.

This year's meeting of the American Association for the Advancement of Science was opened at Ann Arbor, Michigan, August 27. In section A, papers were heard on subjects relating to the sun and planets and astronomical instruments. In section B, Professor S. P. Langley, of Allegheny, opened with a paper on "The Spectra of Some Sources of Invisible Heat," describing experiments with a spectroscope which had been engaging his attention for the past two years, which had led him to believe that the wave length is greater than heretofore believed. Other papers were read on different phases of optics, E. S. Nichols closing the first day with a paper on "The Chemical Behavior of Iron in the Magnetic Field."

In section C, papers on "Butter Crystallization," "Colorimetric Method for Estimation of Phosphorus in Iron and Steel," and a few other technical papers were read. C. F. Mabery, of Cleveland, had a paper on "The Electrical Furnace and the Reduction of the Oxides of Boron, Silicon, Aluminum, and other Metals by Carbon."

In section D, "Strength of Staybolts in Boilers," "Universal Form of Pressure Motor," and "Use and Value of Accurate Standards for Surveyors' Chains," were the first papers considered by the section on mechanical science, and a committee reported as to the best methods of teaching mechanical engineering.

In section E, Professor Alexander Winchell described the geology of Ann Arbor, and the second paper was on "The Lower Helderberg Period in New York." L. E. Hicks, of Lincoln, Nebraska, had a paper on "The Structure and Relations of the Dakota Group," in which he gave an arithmetical statement of the strata and their composition in that region. A. H. Worthen, of Springfield, Ill., read a paper on the structure of the quaternary deposits of Illinois, and G. H. Gilbert, of Washington, followed with a discussion of "Post-Glacial Changes of Level in the Basin of Lake Ontario as observed in the Old Beach Outline of that Lake." Professor Alexander Winchell, of Michigan University, discussed sources of trend and crustal surpulsages in mountain structure.

In section F, papers were read on "Cross Fertilization," "Germination," "Influence of Cocaine and Atropine on the Organs of Circulation." Professor C. V. Riley had papers on the "Song Notes of the Periodical Locusts, and how they are produced" and "Some Popular Fallacies and New Facts Regarding the Seventeen Year Locusts." J. C. Arthur, of Geneva, N. Y., advanced proof that bacteria are the direct cause of the disease in trees known as "pear blight." The "Mechanical Injury of Trees by Cold" was treated by J. J. Burrill, of Champaign, Ill.

A Simple Method of Fixing Crayon Drawings on Paper.

Prof. F. P. Dunnington, University of Virginia, says: It is frequently desirable to preserve drawings made on the blackboard for purposes of class illustration. All such drawings may be readily made with colored crayons upon unsized paper, and then fixed by passing the paper through a bath of dilute varnish, consisting of one part dammar varnish and twenty-five parts of spirits of turpentine. The paper is then allowed to dry over night, and may be handled and rubbed without blurring the drawing.