if, therefore, the engine we calculated of 9½ tons total weight carries 4,540 pounds of water it would require 550 pounds of steam at the commencement of each journey. According to the facilities provided for charging the reservoirs the time required between the arrival of a locomotive and the departure of its train varies between twenty and thirty minutes; if, therefore, a train is to start every five minutes from four to six engines will always be in the boiler house for charging. Adding to a journey of forty-five minutes, twenty-five minutes for charging, we have seventy minutes as the total time employed, and if trains are to run every five minutes, fourteen locomotives will be required, of which nine are running while five are being charged. Since these engines would probably be worked five days out of six, only three more engines would be required, and a reserve of three more would complete a plant of twenty locomotives for a constant service. If this service is carried on with the locomotives we have been several times referring to, of 9½ tons weight, we should require three boilers of 720 square feet of heating surface, each to supply twelve engines every hour. The stationary plant should, however, of course, have one standing boiler, and consist of four boilers of this size.

This system of fireless engines was first introduced by Dr. Lamm, of New Orleans, in 1872, and the first engines were started on this principle in 1874. Dr. Lamm, however, died soon afterward. M. Lion Francq, of Paris, built an engine on this principle in 1874–75, in which he introduced numerous improvements, and in the following year a series of careful trials were made with these engines. At present M. Lion Francq is manager of the Compagnie Continentale d'Exploitation des Locomotives sans Foyer in Paris, and this company is working the system of fireless locomotives.

The Hohenzollern Locomotive Works, at Düsseldorf, are at present building a large number of fireless locomotives and plant for Java, and an interesting series of comparative trials is now being carried out on an experimental line near to these works between fireless and ordinary locomotives.

The fireless locomotives are being fed from one of the stationary boilers built for Java, and run the whole distance for which they are afterwards intended, drawing behind them the proper train weight. These trials afford an excellent opportunity for all interested in light and cheap steam tramway traffic to compare the fireless with the old system.—*Engineering.*

Aconite in Dysentery.

Dr. Owen reports the results of one hundred and fifty-one cases of *acute dysentery treated with aconite.* He was induced to look about for another treatment than the conventional one with ipecac, on account of the nausea which often attends the latter, and which often drives hospital patients, especially, to rebel against a repetition of the dose. Dr. Owen gave the tincture of the British pharmacopœia, which is of one-sixth the strength of Fleming's tincture. He gave one minim every fifteen minutes for the first two hours; after that, one minim every hour. This would make thirty minims in twenty-four hours. Dr. Owen feels that his experience in one hundred and fifty-one cases justifies him in speaking quite positively in favor of the treatment. In his paper he gives a very good analysis of his results.—*N. Y. Med. Journ.*

Quick Work at an English Colliery.

A note was made recently of an example of rapid raising of coal at an American colliery. The following, which is regarded in England as a remarkable instance of expeditious work, will serve for comparison: Pit No. 3, Newlands, near Baillieston, Braehead Collieries, is 120 fathoms deep. The engines are coupled horizontal, 18 inch cylinders, 4 feet 6 inch stroke, and the quantity of tubs drawn from the shaft for one shift was 1,865. The cages are double, holding two tubs abreast. For one hour's winding during the day there were drawn 240 tubs, giving an average for drawing, changing, etc., of 30 seconds for each "tow." The above quantity is coal only, so that including rubbish, etc., drawn during the shift, there were considerably over 1,900 tubs brought to the bank. The average output is about 1,600 tubs per day.

Waterproof Paper.

According to the *Journ. Soc. of Arts*, a strong, impervious parchment-paper is obtained by thoroughly washing woolen or cotton fabrics, so as to remove gum, starch, and other foreign bodies, then to immerse them in a bath containing a small quantity of paper pulp. The latter is made to penetrate the fabric by being passed between rollers. Thus prepared, it is afterwards dipped into sulphuric acid of suitable concentration, and then repeatedly washed in a bath of aqueous ammonia until every trace of acid has been removed. Finally, it is pressed between rollers to remove the excess of liquid, dried between two other rollers which are covered with felt, and lastly calendered.

Washington Monument.

Washington monument now exceeds 300 feet in height, and is rising at the rate of about a foot a day. The workmen are protected by a strong netting which surrounds the top of the monument. Already the net has saved the life of one workman, who was blown from his place by a gust of wind.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 354,

For the Week ending October 14, 1882.

Price 10 cents For sale by all newsdealers.

THE JEANNETTE EXPEDITION.—LIEUTENANT DANENHOWER'S LECTURE.

Lieutenant J. W. Danenhower, of the unfortunate exploring expedition in the Jeannette, has prepared a course of lectures on the experiences and results of the expedition, illustrated by large and carefully prepared charts of the regions traversed. His first lecture, delivered in the Brooklyn Academy of Music, October 3, was quite successful.

The dangers of the expedition began when Wrangell Land was sighted, September 6 1879, and the Jeannette entered the ice fields. The sun disappeared September 9, and soon after the vessel was caught in the ice field, which did not relax its grasp until the following June, and then only to allow the vessel to sink. The Arctic night was very dark between the hours of eight and ten of our mornings, but at other times was clear except during storms. The auroras were not so bright as the lecturer had seen at home. Among the displays were auroral curtains and arches.

The absence of icebergs in the part of the Arctic Sea traversed by the Jeannette was specially noticeable. The ice which covered the sea in all directions was true polar ice, the frozen salt water of the sea, which grows from eight to ten feet in thickness in a single winter, and when broken up by the winds and currents becomes tumbled and heaped as "pack ice." The chief amusement during the winter was hunting seals and bears. The bears of that region were not at all formidable, the largest killed weighing about 1,100 pounds. During the first year the crew had bear's meat twice a week, but preferred pork and beans. The diet of civilized life, as afforded by canned meats and vegetables, was not only more acceptable to all, but more wholesome than bear's meat and seal's blubber. The only trouble with the canned provisions was the bad material of the cans. The tin contained lead, and several of the men were poisoned by the tin dissolved by the food stuff in the cans. The summer season proved less comfortable than winter, owing to chilling fogs and the general dampness of the ship.

The sinking of the Jeannette was vividly described. The retreat of boats to the Siberian shore began on the anniversary of the Battle of Bunker Hill, June 17. After Bennett Island was sighted the party were fifteen days going twenty-five miles to reach it. The retreating party was scattered by the separation of the boats in the gale and increasing darkness of September 12. Of the delta of the Lena, Lieutenant Danenhower said that instead of nine mouths, as laid down on the charts, there were really 100 rivers flowing north and cutting up the region into sand banks and mud flats.

ACCIDENT WITH ELECTRIC LIGHT WIRES.

The first fatal accident with electric light wires in this city occurred October 4, the victim being an experienced line man in the employ of the Brush Electric Light Company. He was engaged in splicing a "live" wire to increase its length so that it could be transferred to another and higher pole. To do this without interrupting the current the splice had to be inserted as a loop around the point to be cut; and in making the loop connections the insulating material of the wire had to be scraped away to secure contact of the naked wires. The rule of such work is to complete one connection before beginning the other, and to complete both connections before cutting the wire, exercising meantime the utmost care to avoid touching the wires so as to allow any portion of the body to be brought into the circuit of the electric current or any part of it. By some slip or other unexplained mishap, the line man failed to properly observe these precautions, and the failure cost him his life. He was caught by the wires in such a way that he did not fall to the ground, though he was unconscious from the moment he received the shock. The fact that he did not die instantly is thought to prove only part of the current passed through his body. The palms of both hands were burned. The wire from which the fatal shock was received was carrying electricity for forty lights of 2,000 candle power each.

FIREPROOF UPPER WORKS FOR STEAMERS.

The need of incombustible upper works for river steamers is once more made emphatic by the burning of a magnificent passenger boat with heavy loss of life. Early in the morning of September 30, the Robert E. Lee, one of the finest and fastest of the large steamers plying on the Mississippi River, was destroyed by fire about twenty-five miles below Vicksburg, Miss. The origin of the fire is not known. It was first observed by the engineer, who instantly warned the pilot. The boat was headed for the shore, against which she was driven with such force as to be firmly fastened. All in the forward part of the vessel quickly escaped; of those aft of the fire twenty or more were lost; the rest were picked up by passing boats. Great credit is given to the pilot, John Stout, who, though surrounded by fire, remained at the wheel, and to the engineer, William S. Perkins, who stood at his post until the pilot announced that the boat was ashore. So rapid was the fire that it was impossible for the passengers or officers to save anything but the clothes they had on. Clerk Bell, who gave the warning, was followed by the fire so rapidly that he escaped with great difficulty. The vessel burned, he said, "like gunpowder."

The R. E. Lee was a side wheeler, of 1,479 tons burden; length, 315 feet; beam, 48 feet; with storage capacity for 9,000 bales of cotton. She had 9 steel boilers, each 32 feet long and 42 inches in diameter, 40 inch cylinder, and 10 feet

stroke. She had been newly refitted and painted, the fatal trip being the first of the season. Particularly noticeable was her apparatus for fire protection, which proved entirely useless, so rapid was the progress of the flames.

The inspection records show that she had on board five independent fire pumps, two worked by steam, the other three by hand. In connection with these were 700 feet of hose, with ten openings for attachment at various parts of the boat. These pumps were situated forward, aft, and amidships. In addition to this she had on the hurricane deck or roof 50 buckets, eight barrels, and two large tanks, all filled with water. Two metal and two wooden lifeboats were in their cradles upon the roof and one working boat at the stern. One hundred and sixty life preservers had just been put in perfect order, and eighty-five floats were hung about below, in places easy of access. Her crew list numbered 44, all told, officers and men, headed by a captain, engineer, and steward of the largest experience.

The moral of this disaster would seem to be that of so many other fatal steamer fires; safety is to be sought not in means for putting out fire, but in so constructing the upper works that they will not burn. As at present constructed, of light lumber saturated with oil, our "magnificent" steamboats for river, lake, and Sound service are simply gigantic piles of combustibles in the best shape for rapid burning. Iron hulls are a step in the right direction, but a very short step. For the security of passengers against fire the upper works also must be made incombustible.

THE GREAT COMET OF 1882.

On the 18th of September, a comet of extraordinary brilliancy suddenly flashed from the sky to the amazement and delight of the few fortunate observers whose gaze chanced to be directed toward the heavens on the eventful day. The comet was close to the sun, 3° west and a little south when first visible. The near proximity of his overpowering light had no power to prevent it from being readily seen by observers possessed of ordinary visual powers. It was a superb object in the full daylight, when the stars were hidden in the star depths, developing a well defined nucleus, and a tail a minute long, and giving proof of its wondrous proportions by daring to assert itself in the near presence of the powerful king of day.

Lord Crawford telegraphed its discovery by European observers to the Harvard University Observatory, and, almost simultaneously, the news came that Mr. Miller, of Leon, Kansas, had seen the celestial stranger. Other observers were equally fortunate. There was intense excitement in astronomical circles. The men of science went eagerly to work to find out where the erratic visitor came from, whither it was bound, when it would come back again, and if it were a newcomer or an old friend returning to take a peep at the sun and his family of worlds. Meantime, the comet traveled on in its resistless course, a million miles a day, little heeding the commotion it had caused among the dwellers on this small planet. Daily the distance increased between it and the sun, daily it grew more dim to mortal view, and almost daily in this vicinity was its beaming face hidden by the clouds born of the protracted equinoctial storm. It has now had its day in our view and has passed on where the telescopes in southern latitudes may dimly discern its retreating steps.

The men of science who make cometic astronomy a specialty have exhausted their resources in attempting to learn its history. They have followed its every footstep with scientific scrutiny and mathematical precision, and, as is often the case, have reached results which are diametrically opposed to each other. They agree, however, on two points, that the comet is receding from the sun and also from the earth.

The startling theory advanced by Professor Boss, of the Dudley Observatory, Albany, has excited much interest. In his view, the comet discovered on the 10th of September by Cruls, of Rio Janeiro, is identical with the new comet, and was then near perihelion, which it passed on the 17th. The professor believes that in this comet we behold a return of the famous comets of 1843 and 1880. He accounts for the present short period by the theory that at the two previous returns, it passed so near the sun as to graze the solar atmosphere, thus retarding its flight and shortening its period. According to his supposition, the next period will be still shorter, and we may expect the comet's return in 1884, if not sooner. It will thus keep on, drawing nearer and nearer to the sun until, meeting with some obstacle, it plunges headlong into his incandescent mass and is seen no more forever. This fine theory has the essential drawback that it diminishes a cometic period of thirty-seven years into one of less than three years. It will not be very generally accepted until the year 1884 rolls round and shows the same bright comet in full daylight, or until proof of its actual plunge into the sun brings confirmation strong to support the hypothesis.

Professor Chandler, of the Harvard University Observatory, an authority also in matters cometic, takes a different view of our gossamer-tailed visitor. He does not think that the new comet is identical with that of 1880, or that it will return in 1884, or that it will fall into the sun. The Cambridge astronomer believes that the new comet travels in a track similar to the one of 1880, and that the superb visitor to southern climes during that year is far on its way through unknown depths of space, not to return during the present century. In his view, the present comet is entirely independent of every other member of the cometic family, simply taking the liberty of traveling behind the great comet of 1880 in nearly the same track, and without herald or harbinger, making its first appearance in full daylight as the great comet of 1882.

Professor Chandler gives an approximate computation of the elements of the new comet at Harvard Observatory, on the 22d of September, at 1 o'clock in the morning, Cambridge time:

Time of perihelion passage	1882, Aug. 30, 5
Longitude of perihelion	271°
Longitude of the node	173°
Inclination of orbit	17°
Perihelion distance	27,000,000 miles.

Commander Sampson, Assistant Superintendent of the Naval Observatory, Washington, sends to the astronomers of Europe, this computation of the elements of the new comet as embodying the conclusions of the naval astronomers—24th of September, Washington mean time:

Time of perihelion passage	Sept. 17, noon.
Longitude of perihelion	57° 23′ 8″
Longitude of node	346° 26′ 41″
Inclination of orbit	142° 11′ 40″
Perihelion distance	·0086

Closely resembling comet of 1880.

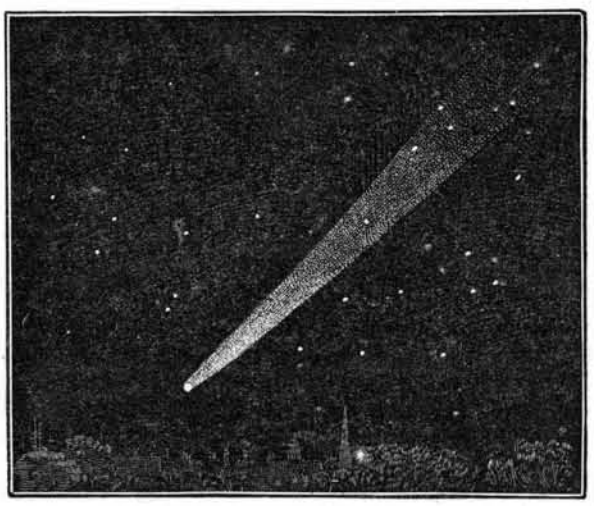
Lord Crawford sends to the astronomers of America, through the Harvard Observatory, the following computation of the elements of the new comet—25th September, Greenwich mean time:

Time of perihelion passage	Sept. 17, 0h. 37m.
Longitude of perihelion	43° 7′ 58″
Longitude of node	342° 39′ 34″
Inclination of orbit	140° 16′ 46″
Perihelion distance	·003279

What can ordinary observers do when doctors disagree? A wise philosophy teaches that the work of the astronomers of the present generation is to observe and wait. It is only observation piled upon observation that will solve the simplest problems that now vex the minds of the students of astronomy. Nothing is more uncertain and unsatisfactory than the attempt to unravel the history of these erratic members of the material universe that suddenly dart upon our vision and as suddenly disappear from view. It is none the less certain that they have a mission to fulfill in the grand economy of the universe. One of these days, some one will find out what this mission is, and the observations made on every comet that sweeps the skies will help to bring about this much desired result.

THE GREAT COMET IN THE EAST.

Those who had the good fortune to see the great comet on the mornings of Sept. 30 and Oct. 1, when it was brightest, enjoyed a spectacle which may not be paralleled in a century. The head of the comet then appeared as bright as Sirius, and its long brilliant tail streamed across the eastern sky in a style fairly answering one's ideal of what a comet ought to be. Notwithstanding the bright moonlight and the growing light of dawn, the comet as a whole rivaled in beauty and magnitude the great comet of 1858 (Donati's) seen under much more favorable conditions.



COMET AS SEEN BY THE EYE.

The cut herewith represents, as well as an engraving can, the general aspect of the comet as seen with the unaided eye, on Monday, Oct. 2. At the earlier dates mentioned, the lower line of the tail was perfectly straight. In receding from the sun the brightness of the nucleus fell off rapidly, so that by the middle of the week it was comparable with that of the second magnitude star Alphard, near the end of the comet's tail.

On the morning of October 5, Mr. E. E. Barnard, of Nashville, Tenn., saw what led him to believe that the nucleus of the comet had separated into three unequal fragments, the dividing spaces being not less than 2,000 miles wide. The entire nucleus appeared to be an elongated bolt, about 24,000 miles long, with a breadth of 3,000 miles. The largest fragment was estimated to have a length of 15,000 miles.

Observations made the same morning by Professor Wilson at the Cincinnati Observatory agreed substantially with those of Mr. Barnard. At the Naval Observatory in Washington the light of the nucleus appeared to be unequal in parts, but so far as observed the light was continuous, from which it was inferred that there had been no split. The nucleus was described by Professor Frisby as longer than on previous mornings, and slightly more spread out, with a small central condensation about three quarters of its length from the end nearest the tail. The tail was about 17° or 18° long. The change in the nucleus does not affect the appearance of the comet to the naked eye.

STORM, FLOOD, AND FROST SIGNALS BY TELEGRAPH AND CANNON.

A short time since a correspondent suggested the employment of cannon signals to supplement the telegraph in giving warning of storms, floods, etc., in regions sparsely settled. The suggestion was not a novel one, but the time seemed favorable for reiterating it. We have since learned that in certain tobacco growing regions the planters have arranged to supplement the reports of threatened frosts sent out by the signal bureau, by means of cannon signals to warn those at a distance from telegraph stations. The plan is likely to prove beneficial and worthy of wide extension.

In considering the value of a system of gun signals, it must be borne in mind that it proposes to fill a wide and important gap in the existing system of weather service. In the first place, the severer and more destructive storms are apt to be of limited range; besides they are largely due to local conditions which make their prediction certainly from a distance quite impossible. And when they are foreseen and preannounced, the information is sent to towns where the telegraphic stations are, while the people to be chiefly benefited are scattered throughout the adjacent country. What is needed is a means of reaching the people as a whole instantly and generally, at their homes and in their fields; which can be done most effectually by sound signals.

In cases of floods, tornadoes, or other sources of sudden public peril, sound signals seem to be by far the most rapid means of conveying a general warning.

In this connection it is due to Mr. Augustus Watson, of Washington, D. C., to say that if not the first proposer of this method of signaling, he has certainly been the most persistent in urging it. He began to publish articles on the subject as long ago as 1867; and in 1868, two years before the establishment of the weather bureau, he proposed it to Congress. Since that time Mr. Watson has made many endeavors to have the plan tried by the Signal Service, but without success.

It is a question whether the Signal Service would be able, if it were willing, to undertake so vast a service as Mr. Watson's plan, adequately carried out, would create. The tobacco farmers seem to be pursuing the more practical course. If the plan works well in their case, it will be taken up by other communities for other purposes. The minute and special distribution and application of meteorological information for local benefit will probably have to be thus undertaken everywhere by the people themselves. The cost of local experiments will not be great, and the system, if found useful, will naturally increase in scope and efficiency until the whole country is covered with its ramifications.

It is possible that something cheaper and more readily handled than cannon might be devised for signaling by sound, a species of gigantic fire cracker, for example, or cartridges of gun cotton, or the like—should the system prove to be of general utility.

TARDILY RECOGNIZED GENIUS.

It is commonly said that genius always finds an opportunity for its own demonstration. This may be true; but it does not always follow that adverse circumstances may not prevent men of genius from doing the work they see ought to be done and which they are personally capable of doing.

A remarkable instance of genius unemployed is casually mentioned in the recent British Association address of the eminent civil engineer, Mr. John Fowler, president of the Section of Mechanical Science. Speaking of great achievements in tunnel engineering, Mr. Fowler mentions his own project for tunneling the silty bed of the Humber, a distance of one and a half miles, the bill for the authorization of which was passed by the House of Commons, but rejected by the Lords.

His plan he supposed to be entirely original until a few months ago, when, turning the leaves of an old periodical, he discovered that it had been substantially anticipated by a working smith by the name of Johnstone, who proposed it in 1823 for the Thames Tunnel, in lieu of the plan adopted by Brunel. Of this working smith's plan, Mr. Fowler says, after describing it:

"There is not a flaw in the design from beginning to end, as modern experience in the sinking of numerous bridge piers on precisely the same plan has amply demonstrated. It is beyond all doubt that if the design of this working smith had been adopted in lieu of that tendered by Brunel the Thames Tunnel would have been completed in a couple of years, instead of eighteen years, and at a cost of about £300 per yard instead of £1,500.

"If another tunnel be constructed under the Thames, which is far from improbable, as the requirements of below-bridge traffic necessitate some such means of communication, I venture to predict it will be built in accordance with the plan suggested fifty-nine years ago by the working smith, and not on that of Brunel's Thames Tunnel, or of any other tunnel yet carried out."

The Basic Iron and Steel Process.

We learn that an interference has just been declared by the Patent Office between Jacob Reese and James Henderson, to determine the question of priority of invention, in respect to the broad claim of dephosphorization of iron after decarbonization by use of basic reagents.