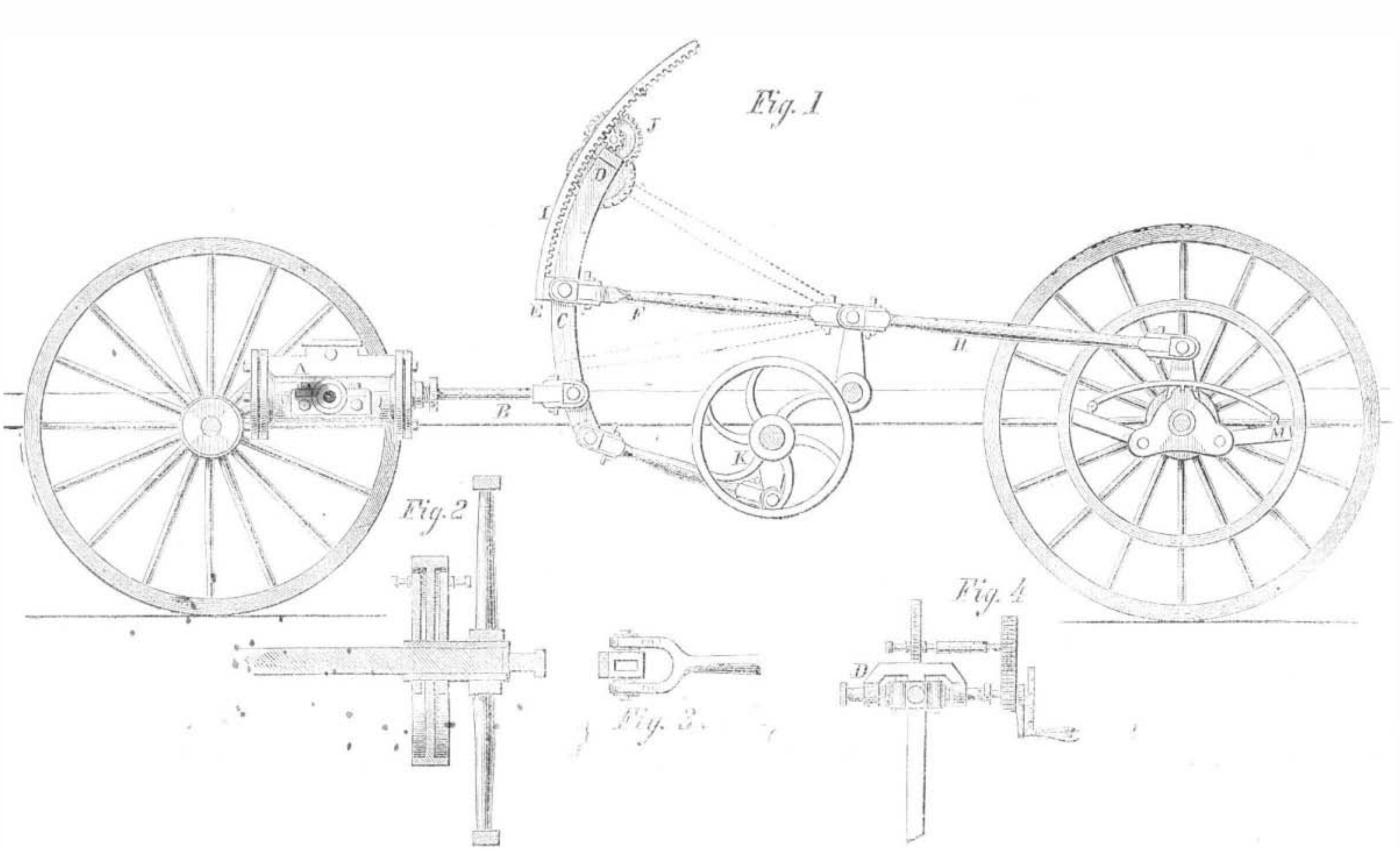
stead of two, thus simplifying the apparatus, reducing the weight, and enabling the machine to be started at any time, for there are no dead centers to overcome, and the motion is easy and continuous. The machine is capable of going in any direction, either backward or forward, by throwing either set of the toggle-jointed arms, M, in or out, and it is steered in front by gear, L, there placed. When the sliding head is moved up until it is in line with the rock shaft it is then at the point of no motion, but the engine yet runs while the carriage stands still. In this way the power may be used for driving pumps or other machinery of any kind whatsoever, and this without disconnecting any rod.



ELEVATION OF STEAM CARRIAGE.

The inventor has some ideas of his own on this subject which we take pleasure in printing as he has written them. He says:—

"Suppose my machine in the same depot with the *John Storms*, when the fire-bell rings and "Barnum's" is on fire. So soon as I get five lbs. of steam I can start and run slowly; by the time I get opposite your office [twenty rods from the depot.—Eds.] I have ten lbs. of steam, and have turned my hand crank and increased the speed two to one. As soon as the steam is high enough for more speed I keep turning the crank and lengthening the stroke, and thus get to the fire as early as any horse-drawn engine. And further, I can get there and have hose all attached by the time my steam is sufficient to throw water, and I have spent no time connecting or disconnecting anything except the hose.

"Let us go back and look after the *John Storms*, which has had to stay at the depot until it is smoking hot; it must have a pressure of steam sufficient to go a whole length stroke, or none, before it can start, and, after it gets to the fire, it must be taken apart and put together again to make a stationary engine of it, during which time poor "Barnum" might get badly burned.

"Some people propose to build three engines to accomplish the object of one fire engine; to do this the engines would weigh twelve tuns. Such an engine would destroy so much pavement that if there was a fire the people in the neighborhood would keep still about it, for fear the engine would come.

"My engine is eight-horse power, weighing fifty-three hundred—which is some ten hundred more than is necessary, it being the first one ever made on my plans. I have ascended grades of one foot in four, and find that climbing steep grades is only a question of time. In different places I work it with a short stroke, and then it runs and continues to run with perfect safety, whereas, if it were the *John Storms*, or an engine that had to make a full stroke or nothing, then I must let on steam until it *started*. As soon as it started it would have too much steam on and would go smash into some catastrophe before it could be stopped. The rotary motion of the driving wheels is perfect, and there is no need of two engines for such a purpose. I can get more accommodation out of one simple lever than there would be in all the cog wheels that an English traction engine would be able to haul."

This carriage was patented November 25, 1862, by Perry Dickson; for further information address him at Erie, Pa.

OUR NAVAL APPRENTICE SYSTEM.

The need of a naval apprentice system which had been once tried in our service and failed, owing to a variety of causes, made itself apparent at the commencement of the rebellion. The scarcity of naval seamen, men who were conversant with the routine and duties of men-of-war, gave the department much anxiety and caused considerable delay in fitting out vessels for the pressing and important demands of that time. It had been supposed that the fishermen, to whom the Government has been paying large bounties for many years, would come forward in the event of war and pay back these munificent gifts which they had been receiving. In this the department were disappointed.

The navies of other powers have their apprentice and training schools, and England especially is noted for her wisdom and foresight in the education of boys for service on board war vessels. In this country the system has at times been ridiculed, although some of our best naval officers have approved the plan, while others have objected to it mainly on the ground that at its organization they would be subjected to the arduous work of bringing it to perfection, forgetting that in these apprentices who, having once become thoroughly instructed in seamanship and naval gunnery, would in the course of a few years become the bone and sinew of our naval strength and pride.

Our apprentice system was formally inaugurated by an act of Congress dated March 2, 1837, but after many disappointments it was abandoned in 1843, and was not revived until 1864. In May of last year the *Sabine* was ordered to be put in commission as a practice and school ship for naval apprentices, under the command of Lieutenant-Commander R. B. Lowry, U. S. N., who was specially selected by the Navy Department for the very important and arduous duty of organizing and establishing on a firm basis the nucleus from which the future rank and file of the navy were to emanate, and in such a form as not only to be reliable at all times, but of a character which would place our vessels upon an equality, if not make them superior, to those of any naval power.

Owing to the want of proper attention on the part of some recruiting officers, and the desire of many parents to place their boys in the service, either in hopes of receiving part of their pay or for the purpose of ridding themselves of troublesome, incorrigible or refractory sons, a large number of worthless, and, in some instances, vicious boys were sent on board. Many persons seemed to think that this was a school of reform for bad boys, and availed themselves of the privilege of confining their wicked offspring in a man-of-war at the expense of the Government. Nothing could have been more foreign to the plan of the Navy Department than the enlistment of such a class of boys, and upon the proper representations the naval rendezvous ceased to take any more boys, and the enlistment was only consummated on board the school ship.

The mistake of careless enlistments was speedily rectified. Under the present system of careful scrutiny and care which is exercised in the preliminary examination, it is almost impossible for any bad boy to obtain admittance into this interesting and promising body of embryo naval seamen. The greatest care is taken in the selection of boys. They must be 14 and not over 18 years of age. At 14 they must measure not less than four feet eight inches in hight and 27 inches around the chest, and at 15 years the hight must be four feet ten inches and 29 inches around the chest. Each candidate must be able to read, write and spell, be free from physical disabilities, well grown, healthy, active, and exhibit an aptitude for the ocean and the duties of sea life.

To guard against bad characters, the candidate must be of good moral standing, not an indentured apprentice, must never have been charged or convicted of crime. He must be a willing applicant, and must have the written consent of his parent or guardian. Parents can rest assured that applicants will be compelled to undergo a thorough examination as to their moral and physical qualifications. It is determined by the department to have none but good and promising boys enter this school; those who will be a credit to the country and will not contaminate the boys who are now on board. Sickly and effeminate boys will not be taken; the Government cannot afford to keep a naval hospital nursery school for invalid boys, any more than to provide a juvenile house of reformation for boys with sea going proclivities. Therefore the public are to understand that any attempt to foist upon the service sickly boys, with a view to improve their health, or refractory boys to establish their future morals, will be met at this school with a firm refusal, and that time and money employed in such efforts will be uselessly expended. The apprentices are bound by the consent of their parents and guardians to serve their country until they are 21 years of age, receiving for their services their living and pay, which varies from eight to ten dollars per month, a portion being retained until the term of service expires.

After passing the examination before the surgeon and instructors, the paymaster furnishes the apprentice, for immediate use, the following articles of clothing:—one pea-jacket, cloth cap, pair of cloth trowsers, flannel over and under shirts, pair of drawers, shoes, neck-tie, socks, white duck pants and frock, comb, knife, pot, pan and spoon, one bar soap, clothes bag, and a badge. The boy is then taken to the ship's corporal, who assists him in the transformation from a landsman to a sailor boy. Next the sailmaker furnishes him with a hammock—his bed until of age. Then the master-at-arms places him in a mess, and at the same time gives him a printed form, on which is registered his number, that of his bag and hammock, a list of his clothing, and points out the place where he is to swing his hammock. Each boy has a number given him when he enlists, and he retains that number as long as he is an apprentice. Thus "191" is always "191," no matter where he is transferred.

For the first two or three days after coming on board the boy is allowed some latitude, and is under the care of the ship's corporal and other petty officers, who instruct him in the general routine of the vessel, and in a familiar and friendly way smooth the first steps of the little stranger. Gradually he begins to feel at home, and on the fourth day of his new life he is mustered before the executive officer, who assigns him to the proper classes for instruction. On the afternoon of that day he is furnished with the balance of his clothing, and from that time he becomes fully identified with the daily routine of the ship and school. The treatment of the boys is of parental character, and made to conform to the requirements of young and growing minds and bodies.

One tailor is allowed to every hundred boys, whose duty it is to repair their clothing, and instruct them in the art of repairing, cutting and fitting their own clothes. The boys *must* learn this branch of nautical accomplishments. One great trouble which has arisen in reference to clothing the boys is, that they are served with men's sizes, none other being made by the contractors. Of course they are too large, and some time must elapse before a new boy can be fitted out in uniform. Much time and considerable valuable material is lost by this state of things. A shoemaker and barber attend to the feet and head of the boys. A fine barber's shop and bath room are located forward on the starboard side of the vessel, and to enforce cleanliness and cultivate a taste as well as the habit for the care of the person is one of the first laws of the school.

The moral training of the apprentices is very carefully attended to by the officers; and the kind, parental supervision of Rev. Mr. Salter, chaplain of the ship, gives a guaranty of its faithful performance. Divine services are held every Sunday, and are of a character both simple and instructive. No pompous or weary discourses are given to prejudice the young and restless mind against religious service, and no sectarianism is forced upon them. A Sunday school to teach Bible history is being organized, and good books and papers are distributed at stated intervals. The boys own a fine and well-selected library of about one thousand volumes. Great care is taken of them, and they are read with much interest.

The naval apprentice system is working admirably, and promises great success. It is of much importance to us as a nation, and is worthy of support and commendation. The sailing corvette, *Savannah*, will be put in commision in a day or two, and be moored in New London as a permanent receiving and practice ship of the school. The steam gunboat, *Tioga*, is now on the Eastern coast recruiting boys. The *Michigan*, on the lakes, is also employed in the same service. It is hoped in a short time to obtain three or four thousand boys for this great work.—*Boston Commercial Advertiser.*

The "Crib" for the Chicago Lake Tunnel.

The walls of the crib are constructed of blocks or logs, hewn square, and one foot in thickness. The distance between the walls is eleven feet, leaving with the inmost wall a pentagonal inclosure, comprising an inscribed crib of twenty-five feet in diameter. The crib is barred so thoroughly that it might be tumbled over without injury. It contains 750,000 feet of lumber, hand measure, and about 150,000 pounds of iron bolts, making in all about 1,800 tuns weight. The outside wall was thoroughly caulked, equal to a first-class vessel, and over it was placed a layer of lagging, to keep the caulking in place and protect the crib from the action of the waves. It will stand about seven feet above the water-line, and five feet will be built above.

The center of the crib is a large hollow space into which a huge cylinder of cast iron, nine feet in diameter, will be lowered in sections about ten feet in length. The lower section will have a chisel edge to cut through the soil. The joists are water-tight, with broad flanges turned true and grooved so as to take in a ridge of cement. The cylinder will pierce the clay to the total depth of sixty-four feet from the surface of the water. After reaching the bed of the lake, the top will be covered with a plate of iron, and the tube exhausted by means of an air pump. The pressure of the atmosphere outside will force the piece into the ground. The air will then be admitted, another piece lowered to it, and the same process repeated. This will be continued till the entire cylinder is fixed. When this is done, all will be ready for the workmen to descend into the tube of the cylinder and proceed to excavating. It is expected that this will be about the middle of September. The water will be pumped out and the workmen will then begin to excavate, striking out to meet those at the other extremity. It is considered to be certain that the engineers have made their calculations so accurately, that the party of workmen excavating from the way of the crib will, in about a year, meet those at work on the present tube, and the walls of the tunnel fit exactly together.

It is intended, when the tunnel shall have been completed, to let in the water through the sluices in the walls of the crib. At this point the water is very pure and clear. It has never been found to contain more than eight grains of solid matter to the gallon; and the distance from shore, two miles, is so far that storms will not affect its quality. The northwestern current in the lake will carry away the filth emptied into the lake round the head and to the Michigan shore. The tunnel ascends or slopes, as it goes out from the shore, about two feet per mile. Many apprehend that the pressure of the water on its first entrance will sweep away the brick work and collapse the walls; but as the bricks are set into the clay, which is almost as firm as solid rock, and the internal pressure of water will be equivalent to that from the outside, this is hardly to be feared. If nothing occurs to interrupt the completion of the tunnel, or to destroy it when finished, Chicago will have secured an inexhaustible supply of as pure and wholesome water as is to be found on the western continent.—*Financial Chronicle.*

The Electrical Torpedo.

We have recently had occasion to refer to the experiments which have been carried out at Toulon with this subtle agent; others have since been instituted on a much larger scale, and with extraordinary results. Hitherto the torpedo has not been properly appreciated as a defense in war; but it is now an established fact that it is as available for defense as ironclads and rifled guns are for attack. Mr. Nathaniel J. Holmes, however, and the scientific gentlemen associated with him, have recently made such progress in this new department of military engineering, that hereafter, in all plans for coast, harbor and river defenses, and in all works for the protection of cities, whether against attack by armies on land or by ships afloat, the electrical torpedo will probably play an important part. The latest experiment made by the French Government at Toulon, affords some idea of the amount of destructive power which lies stored up within the electrical torpedo. With a charge of little more than 100 lbs. of gunpowder, a vessel 150 feet long, and upwards of 40 feet broad, was instantaneously destroyed while floating in deep water in apparent security. At the word of command, given by Admiral Chabannes, a dull crashing sound filled the air, and the devoted craft was effaced from the surface of the water. The portions of the vessel examined afterwards all bore testimony to the tremendous effects of the concussion even with a water depth of 16 feet clear between the ship's bottom and the top of the sunken torpedo, and with a charge of only 100 lbs. of powder. Striking as was the experiment performed by Admiral Chabannes, it is said to have been but a rough indication of the power embodied in the new engine of defense. The French Government have signified their intention to repeat the experiment, and to add to it another in which a ship will be annihilated under full sail. Meanwhile Mr. N. J. Holmes affirms that he has not revealed the secrets discovered by him with respect to the practical employment of the torpedo in warfare. The result of this experiment plainly indicates what may be expected to accrue to even an ironclad, if sailing within range of one of those formidable engines of multiplied power.—*Mechanics' Magazine.*

The Cotton Supply.

Cotton goods are nearly as high now as when gold was at 250—45 and 50 cents a yard being the price for good qualities. The Cincinnati *Times* says:—"From a variety of Southern letters we deduce the conclusion that there will be a very small yield of cotton this year. In pursuance of Jeff Davis's orders the people had generally planted their lands in grain. There will be an unusually large corn crop, which will save the people from starvation, but owing to the scanty yield of cotton, very little money. This will, perhaps, prove a good state of affairs yet for the South. Their old system of labor is broken up, and planters will find it impossible to manage immense farms. They will be compelled to subdivide and sell. This will bring immigration into the country, and the destruction of that wealth which was the sub-stratum of a heartless aristocracy, will conduce to elevate the masses, who have been hitherto kept under."

Filthy Currency.

About fifty thousand dollars' worth of fractional currency, defaced or worn, is redeemed per day, and an equal quantity of new issued in its place. The entire amount of fractional currency being upwards of $21,000,000, the re-issue at such rate of new notes for the whole amount, occurs once only in fourteen months. This period is entirely too protracted, for the notes in that time get dirty, greasy, and repulsive to use. Convenience of the public and a sure preventive of successful counterfeiting could be effected by devising a method of redemption and re-issue that would renew the outstanding fractional currency once in every six months or oftener. The expense of this to the Government would be inconsiderable. A proper standard of cleanliness could be established, and all notes below it paid for taxes or for postage might be retained redeemed, and new ones supplied.—*Internal Revenue Record.*

Gas Machines.—The gas companies will probably have their own way until machinery is perfected by which every family or neighborhood can manufacture its own gas; but the machinery for that purpose is every year becoming more complete and easily managed, by the improvements of inventors who are busy with them. The gas companies of this city and Brooklyn are the best friends of these inventors, for their extortionate charges prepare the public to welcome any change, and hasten the day when no house will be thought comfortably furnished without a gas retort in the cellar.—*Post.*

The propellors *Meteor* and *Pewabic* collided in Thunder Bay, Lake Huron. The *Pewabic* was sunk in three minutes, and from seventy-five to one hundred lives are supposed to have been lost.

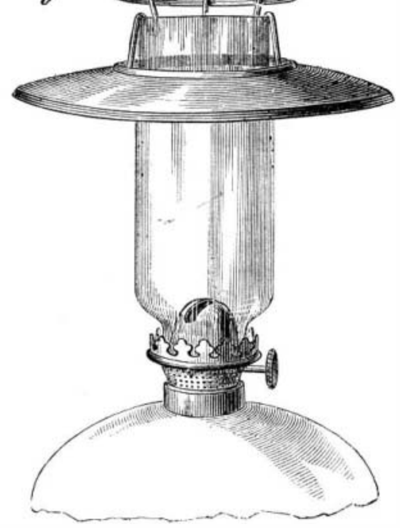
Improved Lamp Chimney.

This chimney is said to be a great improvement over the common ones used on kerosene lamps. The inventor says:—"It is less liable to break from expanding and contracting—being of equal thickness throughout—whereas the ordinary chimney is large in the center and small at each end. As a proof of the capability of this chimney to resist a sudden application of cold when heated, water may be sprinkled upon one of them with impunity, while a single drop upon the others will fracture them. They can be cleaned as readily as a tea-cup, which is quite an advantage. The cap, suspended on the top of the glass by the wires which support the shade, intensifies the light very much, and the heat is not great enough by this arrangement to injure a paper or metal shade in the least. The average breakage of these chimneys is very much less than the ordinary kinds, and they are in all other respects adapted to lamps now in use."

A patent on this chimney is pending through the Scientific American Patent Agency, by Jos. H. Connelly, of Wheeling, West Virginia; for further particulars address him at that place.

Fig. 1

Fig. 2



CONNELLY'S LAMP CHIMNEY.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

Professor Wheatstone has constructed a very powerful thermo-electric battery on the principle of that exhibited by Mr. Ladd at the Royal Institution. The battery constructed by Professor Wheastone consists of sixty pairs of small bars, and its electro-motive force is said to be equal to that of two of Daniell's cells. The battery was recently exhibited to a select circle of Professor Wheastone's friends, and it is stated that "on connecting the terminals of this battery, excited as Marcus's, a brilliant spark was obtained, and about half an inch of fine platinum wire when interposed was raised to incandescence and fused; water was decomposed, and a penny electro-plated with silver in a few seconds, while an electro magnet was made to lift upwards of a hundred weight and a half. Bright sparks were obtained from the primary and second ry terminals of a Ruhmkorff's coil connected 'th the battery. In fact, all the effects obtained from small voltaic combination were reproduced with ease by this thermo-electric battery." In constructing this battery, Professor Wheatstone found confirmation of the curious fact, first announced by M. Marcus, that the power of a battery of this kind is very greatly increased by frequently remelting the alloys of which its elements are composed. This is supposed to be due to the repeated fusion breaking down the crystalline structure of the alloys.

Not unnaturally, this thermo-electric battery is exciting the imaginations of men of science, causing them to call up wonderful visions of a future when much of the work of the world shall be done by *sunshine.* Thus a cotemporary suggests that, "like windmills, thermo-electric batteries might be erected all over the country—finally converting into mechanical force, and thus into money—gleams of sunshine, which would be to them as wind to the sails of a mill. What stores of fabulous weatth are, as far as our earth is concerned, constantly wasted by the non-retention of the solar rays poured on the Desert of Sahara. Nature here refuses to use her wonderfulradiation-net, for we cannot cover the desert sands with trees, and man is left alone to try his skill in retaining solar energy. Hitherto helpless, we need not be so much longer, and the force of a Sahara sun may be carried through wires to Cairo, and thence irrigate the desert, or, possibly, it need be, it could pulsate under our streets, and be made to burn in Greenland." A fascinating dream enough—and one which may prove to be "not all a dream."

In extracting gold and silver from their matrices by the process of amalgamation, the mercury employed often "sickens" and "flours." "Sick" mercury is mercury which has become tarnished at the surface by oxdation; "floured" mercury is mercury which has been tarnished by combination with sulphur. When triturated, in the amalgamating machines, with the rock from which the gold or silver is to be extracted, mercury tarnished by either of the causes mentioned "breaks up into minute particles, which will not again unite, and are carried off with the slimes, so that with many ores the loss of mercury forms a considerable item in the cost of extracting the precious metals." Mr. Crookes, however, the editor of the *Chemical News* and the discoverer of thallium, has found that "by the addition of a small quantity of the metal of sodium the sickening of mercury is entirely prevented, floured mercury is immediately brought together again, and the amalgamating action of ordinary mercury is greatly increased." Mr. Thomas Belt, who has experimented with sodium amalgam, at Mr. Crookes's suggestion, adds the following particulars:—"It is found," he says, "that a surprisingly small amount of sodium is sufficient to effect the clearing of fouled mercury. It will require a longer series of experiments than there has yet been time to carry out, to determine the smallest effectual proportion, but it has already been proved that one 20,000th part of sodium, added to the mercury is amply sufficient, so that this discovery has the great advantage of cheapness to recommend it. Sodium may even now be obtained in large quantities for 5s. per lb., and if a demand were to spring up for it, its price would be greatly reduced; but calculating at the present price of the metal, and using the quantity that experiments have proven to be amply sufficient for any description of ore, the cost is a mere trifle, in comparison with the advantage gained. With the ordinary amalgamating troughs used in mining, 120 lbs. of mercury are used to each set of four stamps, reducing 4 tuns of quartz in twelve hours; the cost would be less than 1d. per tun of quartz treated, which would certainly be more than covered by the loss of mercury prevented, without reference to the greater quantity of gold obtained, in consequence of the improved condition of the mercury" The sodium would seem to produce the beneficial effects thus indicated by virtue of its energetic power of reducing oxides and sulphides.

Interesting Experiments Upon the Auroral Current.

In the month of August, 1859, the beautiful phenomenon of the aurora borealis excited wonder and admiration in the minds of the people, both from the grandeur of the display and its effects upon the magnet c needle, particularly the electro-magnetic needle, with the coil of wire in the circuit of a telegraph line. In addition to the experiments made with the galvanometer at that time, several telegraph lines were worked, messages transmitted, etc., without the aid of artificial electricity, the aurora borealis assuming the entire duty of the usual batteries, and although the work was not performed as well as it might have been done with our usual battery power, without the aid or interference of the auroral current, yet it was a great satisfaction to many wonder-stricken telegraphers, who had never seen the like before.

Many of the effects of the phenomenon and accounts of experiments made upon telegraph lines were placed on record in the various newspapers at that time, some of which were also published in works on electricity and telegraphy. As the effect of the auroral current of Thursday, August 3, 1865, upon the electro-magnetic needle and telegraphic instruments differed considerably from that of August, 1859, we wish to place on record, for comparison with the previous experiments and for future reference, the result of comparatively rude observations, made with instruments, on a wire running from Boston to Springfield, Mass.

Although the auroral current was undoubtedly as powerful as that of August, 1859, it was observed that our wires were not so greatly disturbed by fluctuations (with our usual batteries on duty), but rather showed a weakness of currents, as though the batteries were not in proper working condition, while the effect in August, 1859, was to alternately and continually augment and decrease our battery currents, in consequence of the continual reversing of the polarity of the auroral current, thus making it exceedingly difficult to keep the instruments adjusted for the currents and rendering for a while lines almost useless.

In our experiments on the 3d instant we found, after removing the batteries, quite a powerful and steady current, each wave of which appeared of much longer duration, and the increasing and decreasing of the current more gradual, than was observed in August, 1859. But the most remarkable effect shown in our recent experiments with the galvanometer, was the almost entire absence of the changes of polarity, which were very marked in the experiments of 1859, each wave having been almost invariably succeeded by a wave of opposite polarity.

In the experiments of the 3d instant the positive polarity of the auroral currents was almost invariably west during the observations, which is the reverse of the usual battery currents on the Western wires, thus accounting for the weakness of currents observed previous to the experiments—as the two currents, being generally opposed, were partially neutralized.

The following observations of the needle will roughly show the power, constancy and polarity of the auroral current during the fifty minutes occupied by the experiments:—

The batteries having been removed and the galvanometer placed in the circuit of the wire extending from Boston to Springfield, Mass., at twelve hours fifty-one minutes P.M., a deflection of 3 deg. east was observed, the needle at the time gradually ascending. It should be remarked that a deflection in the needle east in this instance simply shows the polarity of the auroral current to have been the reverse of the usual battery current. After a comparatively steady upward movement of three minutes duration, with an occasional check or slight downward movement (a characteristic observable throughout the experiments), the needle remained stationary at 44 deg. deflection, but for only a few seconds, having descended rapidly to zero in the succeeding thirty seconds. After remaining quietly at zero one minute another ascent was commenced east, stopping at 28 deg. at twelve hours fifty-seven minutes thirty seconds, the duration of that ascent having been two minutes. Remaining at 28 deg. one minute, it descended to zero in one minute and thirty seconds, but immediately commenced another ascent in the same direction, reaching 60 deg. at one hour three minutes, this ascent occupying three minutes. The needle remaining steady at 60 deg. for three minutes,