THE ERICSSON BATTERY.

At the late extra session of Congress an appropriation of $1,500,000 was made for building iron-clad vessels, under a provision that three naval commanders were to approve of all plans before being adopted. The Secretary of the Navy accordingly appointed Commodores Smith and Paulding, and Captain Charles H. Davis to examine and report on the several plans submitted by engineers and shipbuilders. Among others, Captain Ericsson appeared before the committee with a plan of an impregnable battery, which was at once adopted, and the construction of the battery was ordered by the Secretary of the Navy. The contract bears date 5th of October, and stipulates that within one hundred days the entire structure must be ready for active service. In view of the magnitude of the work to be performed this condition would appear almost impossible to comply with, and calls for extraordinary diligence on the part of the constructor. There is another stipulation in the contract of a most remarkable character, and probably without a precedent, viz., the trial of the efficiency of the battery must be made under the guns of the enemy's batteries at the shortest ranges. The United States to furnish guns and ammunition, as well as officers and men.

We have had an opportunity of making a minute examination of the plans of this novel instrument of aggressive naval warfare, and shall probably soon publish an elaborate illustration of it in the SCIENTIFIC AMERICAN. In the meantime the following general description will give a correct idea of its leading features.

The structure consists of three principal parts, viz., a shallow-decked vessel with perpendicular sides, dead flat bottom and pointed ends. Under this shallow vessel a second and deeper vessel is attached with raking stem and stern, perfectly flat bottom and sides inclined at an angle of 51° to the vertical line. This lower vessel does not extend the entire length or breadth of the upper one. It is in free communication with the latter, the bottom of which is cut out corresponding exactly with the top line of the lower vessel. The third principal part consists of a cylindrical turret placed on the deck of the upper vessel. This turret contains the armament, which it effectually protects. We have only to add that a screw propeller is applied aft of the raking stem of the lower vessel, and aft of the propeller an equipoise rudder, both of which are thus hidden under the upper vessel, by which they are most effectually protected; the anchor being in like manner protected by the forward projecting part of the upper vessel, within which it is suspended in a cylindrical chamber open from below. A steam engine, boilers and blowers, all snugly stowed away in the lower vessel, complete the general arrangement of the battery which Ericsson is now building for the government for the purpose of silencing the guns of our antagonists on the banks of the southern rivers. The following particulars will furnish our readers with the necessary data for estimating the chances of success in this important enterprise:—The upper vessel, built of iron, is 174 feet long, 41 feet 4 inches wide, and 5 feet extreme depth. The draught of water will be 3 feet 6 inches, and consequently the projection above water line will be only 18 inches. A wooden bulwark, composed principally of white oak, 30 inches thick, protects the side of the upper vessel, and extends down to the bottom, being thus 5 feet deep. This bulwark is secured to the vessel's sides in a peculiar manner, requiring no through bolts. An armor, composed of rolled plate iron, in all 6 inches thick, covers the bulwark from top to bottom, extending all round the vessel. The stem and stern being both pointed at an angle of 80°, the armor will present a sharp wedge at each end of the vessel of enormous strength. The deck, as it must be shell proof, is made very heavy. It is composed of oak beams, 10 inches square, placed 26 inches apart, the deck plank being eight inches thick, covered all over with double plating, one inch thick. The lower vessel is 124 feet long and 34 feet wide at the junction with the upper vessel, and its depth is 6 feet 6 inches. This lower vessel is built quite light, as it is perfectly protected by the upper one. The manner in which this necessary protection of the lightly-constructed lower hull, propeller, rudder and anchor is attained is the most important feature of this singular structure. The constructor, we find, instead of relying on the water as protection, brings the lower body within such angles that shot cannot strike without first passing through water for a distance of more than 25 feet, and then striking at a very acute angle, 10° at the most; while the propeller, rudder and anchor cannot be reached by shot at all.

The turret, within which two guns of the largest caliber are worked, consists of a cylinder 20 feet internal diameter, 9 feet high, composed of 8 consecutive rings, each one inch thick, all firmly bolted and riveted together. There are no horizontal joints, the plates lap over each other in such a manner as to present a single joint only at any one place. Including the interior skeleton to which the plates are attached, the turret presents an immense wrought-iron cylinder, 9 inches thick, weighing upwards of 100 tuns. The top is covered with a shell-proof flat roof, placed six inches down the cylinder; it consists of forged beams covered with perforated plate iron. Several sliding hatches, composed of 2 inch thick plate iron, give access to the turret from above. The port holes are circular and placed 3 feet above the decks. The guns will move on slides made of forged iron extending across the turret; the carriages, also composed of wrought iron, are made to fit the slides very accurately, these latter being planed for that purpose. The circumference of the turret rests on a turned composition ring inserted in the deck, but the weight is sustained principally by a vertical shaft, 10 inches diameter, which rests in a cup supported by a bracket firmly bolted and braced to the main bulkhead of the vessel about half way down. A spur wheel 6½ feet diameter, 11-inch face is attached to the turret shaft. By means of the spur wheel and intermediate gearing, actuated by a double cylinder engine, the turret will be turned and the guns pointed in any direction. A rod connected with the reversing gear of the engine, passes through the vertical shaft, and enables the person in charge of the guns, to control the aim. For a contest with iron-clad ships carrying the heavy ordnance recently devised in Europe, captain Ericsson proposes to dispense with two of the outer plate rings of the turret, and to attach in their place staves of rolled iron 4 inches thick, thus presenting an aggregate thickness of 10 inches of plating besides the internal skeleton.

The steam machinery and propellers now being built for the battery demand no special notice at present. The cylinders are 40 inches in diameter and 22-inch stroke; the boilers are on the horizontal tubular plan. The blowers for the boilers and for ventilating the vessel will be actuated by separate engines, as usual. Smoke pipes above deck will be entirely dispensed with during active service, the products of combustion passing off through shell-proof gratings in the deck.

Extraordinary exertions are being made to complete the work within the time specified, the number of hands now employed being estimated at 1,000. Three of the largest rolling mills are at work on the plating. Messrs. Corning, Winslow & Co., Abbott & Son and Holdane & Co., all contribute to their utmost ability. The turret is being built at the Novelty Works, the whole of the tools and machinery usually employed in iron ship building in the establishment being now devoted to the work connected with the turret. The main engines, boilers, propellers, &c., are being manufactured at the Delamater Works. The turret engines, gun carriages, &c., are being made by Messrs. Clute Brothers, of Schenectady. The hull and works connected with the deck are being carried out at the Continental Iron Works, Green Point, a considerable portion of the force being employed day and night.

HAND LAMP.—We have been using for some time past a very convenient hand lamp, designed by J. E. Ambrose of Jersey City, N. J. It is a coal oil lamp, dispenses entirely with the chimney, and affords a light equal to three ordinary candles. It is a very convenient and safe arrangement, and for common household purposes the best plan we have yet seen.

THE phosphorus disease, a terrible malady which rots the bones of workmen in lucifer match factories, &c., is said to be curable by the use of bichromates. M. Ponsier, a French chemist, who has investigated this subject, declares that the best remedy is bichromate of ammonia.

California Cotton.

The San Francisco *Mercantile Gazette* says:—"We were shown a few days since a sample of cotton raised in Tulare county, which in length of staple, fineness and strength, we found nearly if not quite equal to good middling Louisianas. It was deficient in color, having been bleached probably by too long exposure after opening, but the fiber was excellent. From our recollections of the King's river and Four Creeks region of country, we have no doubt that large tracts of land can be found there, well adapted to the culture of cotton. It is certainly worth the trial. A sample of cotton raised near Salt Lake city was also shown to us not long ago, part of a crop of 100 bales (if we remember correctly), and about equal to middling Tennessees. It was slightly stained, and not well handled, but fair in body and staple. We regard these facts as unequivocal indications of the capability of our State to produce cotton in quantity. The plant requires moisture, and sufficient length of season, to mature between late and early frosts. There are certainly many localities in the state where these requisites can be found."

The Quantity and Clip of California Wool.

In the first annual report, lately issued, of the California Sheep-Raisers' and Wool-Growers' Association, it is stated that the number of sheep in that State is estimated at 1,574,666 from one year old and upward. The daily consumption of mutton is 2,300 sheep per day, or 839,500 per annum. The prices of sheep have advanced 60 per cent since July last. The clip of wool for this year is 4,544,000 lbs., of which 3,069,000 lbs were shipped for New York, Boston and England. The report states that no less than 10,000,000 lbs. of wool will be required this year for army purposes. The average cost for maintaining sheep in California is 75 cents per head per annum. The average weight of fleece is 3 lbs. Some very large flocks of Australian merino ewes have lately been imported; their yield is 6⅜ lbs. of fleece each.

Messrs. Flint, Bixby & Co., sheep raisers, of San Juan, in Monterey county, California, have clipped 100,000 pounds of wool from their flocks this year. Several of the sheep yielded 12 pounds, and one buck a 25-pound fleece. The yield of wool on the sheep in California is greater than on those in any other country in the world. The climate is most favorable for sheep raising.

IRON CEMENT.—To prepare iron cement for stopping leaks, take sixteen parts of clean wrought-iron filings, three parts powdered salammoniac and two parts flower of sulphur; mix all well together, and preserve the compound in a stoppered vessel and in a dry place till wanted for use. Then take one part of the mixture and add to it twelve parts of clean iron filings, and mix this new compound with as much water as will bring it to the consistency of a paste, having previously added to the water a few drops of sulphuric acid.

ON the first week of last month (October) the river Nile overflowed its banks, and Egypt experienced an inundation unparalleled for 25 years. Villages were flooded, crops of corn and cotton swept away, and desolation spread far and wide. A vast extent of the delta of the Nile presented the aspect of a lake.

MR. J. NICHOLS relates, in the *Lancet*, an interesting instance of complete separation of the nose from the face, with a transverse division of the upper lip throughout its whole extent, so as to allow it to hang down over the mouth, both of which readily reunited on being replaced, and kept in their appropriate positions.

THE Philadelphia *Press* states that no less than eight firms in and around that city are engaged in making swords for the army. Henry Diston, of Laurel street, Philadelphia, has converted his extensive saw factory into an establishment for making sabers and other cavalry equipments.

Dr. DOUGLASS, in his report to the Sanitary Commission of his visit to the camps about Washington, states that in all the regiments but four, a majority of the soldiers are Americans. Two of the regiments are composed of Irishmen, and two are composed about equally of Germans, Irishmen and Americans,

Interesting Facts about Army Mules.

[From the Cincinnati Commercial.]

At Perryville, opposite Havre de Grace, twenty-five miles northeast from Baltimore, a great mule and wagon depot has been established. The American flag at that point waves in triumph over 6,000 mules and 3,000 wagons, with arrivals every day. A thick cloud of dust hovers over the region round about, and the air is resonant with multitudinous brays, intermingled with the hoarse cries of the mule-breaker.

Coming down from Port Deposit in a buggy, by the river road, in the outskirts of the city, we came upon a vast *corral* of United States wagons, inclosing a space of five or six acres. Inside of the inclosure we noticed a perfect forest of long ears and a compact mass of black hides working and surging to and fro. There are quite a number of these pens near Perryville, each containing 1,500 or 2,000 mules, collected from all parts of the country, and stored in these pens to await the process of breaking.

Some distance from the pen we found the breaking ground, where about 100 lusty darkies were engaged in the work of taking the mules through a rudimentary course of instruction preparatory to fitting them for duty in harness. The process of breaking is exciting and interesting, and not unattended with danger. The mule is driven into a "chute" just the width of his body, with strong wooden bars on each side, which prevent his kicking out laterally, and at the same time admit of his being handled through the cracks. A rope is then fastened to his jaw, and another tied as a girth around his belly; after which one is attached to his fore foot, and passed under the girth and out at the rear, in which condition he is turned out for the preliminary exercises, consisting of a series of frantic plunges, with some ludicrous ground and lofty tumbling, vicious attempts to bite, and strike with his fore feet. The exercise continues for a longer or shorter period of time, according to the intelligence and obstinacy of the subject. But your mule is not altogether such a fool as he looks, and after coming to grief a matter of a dozen times by means of the check rope, he wisely concludes that plunging and rearing is not remunerative, and lies still, either reflecting or groaning piteously. If unusually obstinate through the first course, he is trotted round the course at double quick, and his hide copiously anointed with a stout cudgel. After the first course, the mule then being supposed to have absorbed something of the rudiments of his education, it is reconducted to the "chute," where he is invested with harness and again led forth, and another series of gymnastic exercises takes place. After becoming somewhat accustomed to the harness, the mules are hitched up to the large wagons, and driven around the course. The operation of hitching up is a delicate one, requiring great care. The negro approaches cautiously and gingerly, with his eyes fixed on the mule's ears. A suspicious movement of the auricular appendages is seen, and the startled African springs backward as quick as lightning, just in time to escape a flashing pair of heels. Again he approaches, and finally succeeds in hitching up. A brace of broken mules are usually put in the rear, with a team of wild ones in front. Different phases of mule character are developed in the process of starting. Some plunge and rear all the time, others lie down and obstinately refuse to move; others kick out of the traces, face on driver riding the saddle mule, rear up and viciously strike at him with their fore feet. Again one will remain properly quiet for a time, and then spring forward to the full length of his traces with such violence as to bring him to his knees. Nothing but the natural obstinacy of the mule prevents a general smash up. Fortunately while one plunges forward, the other through sheer perverseness, will pull back. Sometimes a forward mule will turn round in his traces, come to a dead halt, and stare at the driver in the most ludicrous and side-splitting manner. In shoeing mules, a broad leather belt is passed around his belly, and the mule hoisted clear, when his feet are drawn back and fastened, when he helplessly submits to the operation of shoeing, entering sundry protests in the way of snorts and groans. Currying is an operation which hardly pays for the danger incurred. The mule is altogether too handy with his heels to render it a desirable employment. Sometimes a curry-comb is fastened to an eight-foot pole, when the groom stands out of range and rakes him down from "long taw." Watering the mule is not the least interesting of the operations that I witnessed at Perryville. The mules to the number of a thousand at a time, were driven down a small ravine in front of a hotel, spreading at its mouth to a width of about a hundred yards into the river. They rushed far out into the stream, so that most of them were covered with the exception of their heads floundering and plunging, and lashing the water into foam, and all braying continually. They reminded me forcibly of a school of immense porpoises sporting in the water. Negroes are exclusively employed in the breaking and training of mules at Perryville. I asked one of the men superintending the matter why this was so. "Well," said he, "a nigger is the next thing to a mule anyhow. They understand each other better, and there is a natural affinity of character between them. The niggers like it, and I believe the mules like it too. At any rate, a nigger can break a mule twice as quick as a white man, and get more out of him after he is broken. We tried white men, but it wouldn't do. The mules have no confidence in them."

They break about a hundred and twenty long ears a day at Perryville.

California Silk—Labor-Saving Machinery.

The following are some very interesting extracts taken from the speech of Mr. Wilson Flint, delivered before the Agricultural Society at Eldorado, Cal., in the month of September last. He said:—

A vast region, stretching almost from the equator to the north pole, along the center of the American continent of more than a thousand miles in width, is richly sown with mineral substances, and over vast portions of which the ban of the Almighty has forbidden the introduction of the reaper and the cotton gin. Here millions of the human race may find employment through all coming time in delving for hidden treasures deeply buried; while just on its western margin will be found the vine-clad hills of California, teeming with its happy people, amid luxury and contentment.

Not the least important among the many satisfactory results of arboriculture in our State, and especially in the mountain districts, is the entire success in the growing of the white Italian mulberry tree. The luxurious tendency of the age producing an increased demand for silk fabrics, renders its production a matter of first importance in countries where it can be raised. The gathering of the mulberry leaves and feeding them to the worms, and the various little attentions required by the operations of the cocoonery are of a fascinating character and well calculated to promote industrious and cheerful habits, and a higher order of intelligence among those devoted to this lucrative business.

The day is not far distant when California will become as celebrated for the unequaled texture of its silks as for the various products in which she already excels all other countries, and at the risk of raising a dubious smile on the countenance of some victim of the *morus multicaulis* fever of a quarter of a century since, I earnestly urge upon our people to plant the mulberry, for shade and ornamental purposes, as no tree is of more rapid growth, and its entire exemption from the attacks of the insect tribes makes it an agreeable associate of residences and the vicinage of orchards and vineyards. In no long time silk should become one of our staple articles of export.

Marvelous innovations have taken place in the fields of human labor during the last quarter of a century, by the introduction of labor-saving machinery, and, though it has tended to multiply human employments, yet it is driving manual labor to the wall in almost every branch of industrial enterprise. The substitution of the reaper, mower and threshing machines, for the sickle, scythe and flail, has ameliorated harvest labor to such an extent as to have produced a social revolution in our agricultural districts, while the recent successful experiments with the steam plow promises the the near approach of the time when hunger shall be fed almost exempt from the sweat of the brow. When the steam plow shall have been introduced to our great wheat-growing plains, the small farmer will be forced to turn his attention to other branches of agriculture. With the steam plow and a machine to pick cotton —which will be invented when its want becomes a necessity—human labor may forever drop cotton growing. Against these certain results, which are nigh their accomplishment, the Allwise has made ample provision for the myriads who will be forced to seek new fields of labor.

NEW ELECTRIC LIGHT.—The London *Times'* Paris correspondent says:—"A trappist, named Delalot-Sevin, of the Abbeye de la Grâce-Dieu, has made a discovery which will probably produce a revolution in the system of lighting and heating public and private buildings. He has invented a new pile much stronger, and at the same time much cheaper, than the pile of Bunsen. By means of his photo-electric apparatus he produces an electric light as cheap as gas; and with his thermo-electric pile he supplies caloric on economic terms hitherto unknown. Several of these apparatuses have been constructed, and one is at full work in the Abbeye de la Grâce-Dieu. Manufactories for the public are shortly to be established in Paris and at Lyons. The apparatus for producing gas will not be given to the public until after the Exhibition at London, next year; but that for heating buildings will be made public on the 16th of December next. The inventor has been authorized to make public experiments with his system of lighting on the Place Saint Jacques, in Paris, and on the Place Bellecourt, at Lyons."

Expansion and Controlling the Momentum of Steam Engines.

In the number for this month of the *Journal of the Franklin Institute*, Mr. Samuel McElroy, C. E., concludes his criticism of the official report of the Erie steam experiments, from which we select the following, as bearing upon an important and scientific appreciation of the use of the cut-off. It freely explains the well known benefits which result in common practice from using the cut-off on locomotives and all engines in which high-pressure steam is used. He says:—

A certain mechanical principle underlies and controls the whole question of expansion, although its connexion is not commonly recognized. A principle which belongs to the primitive formations of all engineering theory and is indissolubly united to the very elements of motion. Our allusion to it involves a slight historical discussion.

In the abstract of this report Watt is credited with the first applicatiod of expansion as suggested to him by the announcement of Mariotte's law. The writer is in error in two respects; first, by the fact that Hornblower preceded Watt six years in the application of expansion as a source of economy, and second, that Watt's original application of the cut-off was made in view of the great principle to which we allude, viz., the effect of the *mass of an engine in motion*. Nor is the speculation as to Watt's unpublished experiments on expansion leading him to adopt a steam travel of three-quarters probable, as he made the mistake of the Erie Board and vitiated the results within his reach by using too low pressure. He proposed in 1782 to cut off at one-quarter. Trevithick, in 1806, apprehended the question of economy much more fully, using steam at 40 lbs., and proposing to build an engine to cut off at less than one-sixth. And since that time, the whole Cornish school, instead of confining itself to this standard, has carried the grade of expansion in some cases to one-twentieth, not for purposes of experiment, but for regular duty. It is a very great mistake to suppose or to assert that, "until quite recently, it was the exception, and not the rule, to find new engines cutting off at less than one-half."

But without pausing here to sustain a very simple matter of record, we refer again to the fact, that when the genius of Watt superseded the *atmospheric* engine and used steam as a driving power, it also comprehended an inevitable law of motion, which demanded the application of the cut-off as a mechanical necessity, in advance of any idea of economy. We take an impregnable position, then, based on absolute principles, when we assert that the cut-off is an appurtenance which bears to every engine in full motion a relationship entirely independent of any question of economy, although this is a natural sequence, and that the idea of assuming full steam travel as a basis of comparative mechanical action is a misapprehension of engine duty.

The argument on this point is sufficiently clear in reference to all bodies in motion which have weight. To overcome the inertia of an engine, a certain surplus pressure must be applied to the piston, which corresponds with initial pressure, and is exceeded at no after point of the stroke. The mass being thus put in motion by charging it with surplus power, it is a mechanical absurdity to continue the initial pressure any further than will suffice to complete the stroke by virtue of the surplus power imparted at the commencement. In the general application of this law, there is no distinction between single-acting and fly-wheel engines; mass in motion characterizes both.

It is an absolute necessity, then, in every engine, that the power necessary to complete its stroke properly, must be imparted to it in excess at an early period of such stroke; and inasmuch as the whole experience of the steam engine in practice abundantly confirms the theoretical conclusion that this surplus power may be exerted at a very early point of motion, this disposes of the expansion question, not only as to mechanical effect, but as to economy. For all the fine drawn arguments on condensation and re-condensation are of very little consequence to the mass which is by this time distributing its excess of power.

Viewed in this light, the doctrine of expansion divests itself of all incumbrances. We come back again to the principle of max mum useful effect. There is a given velocity to be imparted to a given load at the start. If a steam travel of four feet under ten pounds pressure will do it, who is to assert that a travel of one foot under forty pounds pressure will not do it equally well, better in fact, and much more cheaply? No experimental philosophy can prevail against a plain mechanical law like this and certainly no such experiments as those we have here discussed. On the contrary, the most extensive, severe, laborious research, by the first men of the age, has brought out this law "seven times refined" for the benefit of the world. So long as we know that the maximum velocity of motion can be imparted to an engine before it reaches the half-stroke, we decide the fallacy of any argument which prescribes any latter point of cut-off; and we also decide that the only limit to economy of steam by expansion, is to be determined by the practicable conditions of such initial motion, and the practicable perfection of construction.

COPPER.—At Ontonagon, Lake Superior, the National mines yielded 107 tuns 1,078 lbs. of copper in the month of September last. Of this amount there was 123,487 lbs. of it in masses. A French company is going to erect copper smelting works in the Ontonagon district next spring. The processes of smelting to be introduced are said to be superior to those practiced at our copper works.