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IRON-CLAD VESSELS BUILDING AT NEW YORK.

An immense iron-clad fleet is now in the course of construction in this port, and the most intense activity is being displayed to complete some of these vessels at an early date. At the Continental Works of T. F. Rowland, Green Point, five turret ships are in progress, and one of these has been launched, and will soon be finished. They are called the *Passaic, Montauk, Katskill, Onondaga* and *Puritan.* The latter will be 320 feet in length, with a beam of 50 feet. At Colwell and Co., Jersey City, the turret ship *Weehawkin* is being rapidly pushed forward; and at the Delamater Iron Works, the *Dictator*—a double turret Ericsson 350 feet in length, with a beam exceeding 50 feet—is also being urged forward with great energy, there being about 1,000 men employed upon her.

Besides these seven armor turret vessels, ranging from 200 to 350 feet in length, now in different stages of progress, W. H. Webb is also about to commence the largest iron-clad war vessel yet designed. Her length will be 360 feet, beam 78 feet. She will be 7,000 tuns, and have engines of 5,000-horse power. In addition to being furnished with two turrets she will have a common gun deck, and her accommodations will be as ample for her crew as those of a wooden frigate. Her plates are to be 4½ inches thick and she will be of light draft in proportion to her size owing to her great breadth of beam. A small iron clad is also being built at Jersey City for the defence of San Francisco harbor as a floating battery. She is being built in sections, which will be put together when she reaches her destination.

These vessels are all of the revolving-turret class, designed, we understand, by Captain Ericsson. The *Roanoke*, one of our wooden steam frigates, is now at the Novelty Works, having the remainder of her plates put on. She is of the *La Gloire* class, and will be a very efficient vessel, we believe. At the Dry Dock Iron Works, Mr. S. W. Whitney's novel armor gunboat, the *Moodna* is in a forward state. She will have two stationary gun turrets, and be propelled by two screws, driven by two pairs of powerful engines.

We have thus briefly enumerated no less than eleven armor war vessels now being built at this port for our navy. The smallest of these vessels will be a formidable war ship to encounter, but the three largest will be perfect leviathans, especially as they are to be armed with 15-inch Dahlgren guns—the largest in the world. They will all be capable of acting as rams also, but in this respect their efficiency will depend chiefly on their speed. And besides this large iron clad fleet for the American navy, two powerful iron-clad frigates are also being built by W. H. Webb for the King of Italy. The frames of both of these frigates are put together, and the planking of one is in a forward state. These two frigates will be of the *La Gloire* character, the framing being wood and the outside covered with 4½-inch plates. Each is about 280 feet in length with a beam of 55 feet. The sides will be no less than 33 inches thick—oak 28½ inches, the iron plates 4½ inches. The latter are to be made in France and sent out to be put on. Each frigate will have two fighting decks, the upper one being armed fore and aft with eight very large guns, the under deck with sixteen guns on each side. The construction of these two armor-clad war vessels in an American port, and by the designer and builder of the *General Admiral*, affords evidence of the esteem in which American shipbuilders are held abroad.

THE WAY THE VELOCITY OF CANNON BALLS IS MEASURED.

We recently had an opportunity of examining the instrument in use at West Point for measuring the velocity of cannon and musket shot, and we found it an exceeding ingenious piece of mechanism.

In front of a graduated arc, two pendulums are hung upon the same axle, one a little in front of the other, so that they may swing past each other. Each pendulum carries a block of iron near its lower end by means of which it is held in a horizontal position by an electro-magnet; one pendulum being raised up on one side of the arc, and the other upon the other side. The cores of the electro-magnets are made of the purest soft iron, so that when the circuit of electricity which passes along the wire around them is broken, they will be instantly demagnetized, and will consequently allow the pendulums to drop.

The wire from one electro-magnet is carried out of doors, and drawn repeatedly across a frame work target just in front of the muzzle of the gun; and the wire from the other magnet is drawn in the same way across a target at 100 feet greater distance. The gun is fired, and as the shot passes through the targets it cuts the wires of both circuits; allowing the pendulums to fall. But the wire near the gun is cut sooner than the one more distant, and, consequently, the pendulum which is supported by its magnet begins to fall sooner than the other pendulum. The pendulums therefore do not pass each other at the lowest point in the arc, but at a distance from the lowest point, which depends on the time occupied by the shot in moving from one target to the other.

The exact point on the arc at which the pendulums pass each other is indicated by a little prick made in the arc as the pendulums meet. To effect this the pendulum nearer the arc carries a pin pointing toward the arc, the outer end of the pin having a beveled head which is hit by a projection on the other pendulum as the two meet, driving the point into the arc.

The time occupied by the pendulums in making their oscillations is ascertained by careful observations, and then the time required for their passage through any portion of their arc is known by calculation. The instrument is always very nicely adjusted immediately before it is used, and the experiments must be conducted with the utmost thoroughness in every respect. When all the conditions are carefully complied with, the velocity of shot is probably measured with more accuracy by this instrument than by any other means yet devised.

The idea of using electricity for determining the velocity of projectiles was first suggested by Wheatstone in 1840, and a machine devised by Captain Navéz of the Belgian service was tried in this country, but was found too delicate and complicated for general use. The machine which we have described was designed by Captain J. G. Benton, late Instructor of Ordnance and Science of Gunnery, Military Academy, West Point. It is called the electro-ballistic machine.

EXTRAORDINARY PENETRATION OF ARMOR PLATES.

During the past week we have had a constant succession of visitors calling at our office to see some iron plates penetrated by a steel bolt which was driven through the plates by being discharged from a gun; and a great deal of wonder has been excited by the exhibition. There are twelve plates of boiler iron, each ⅜ of an inch in thickness, all pinned together by a bolt a little less than half an inch in diameter. The bolt weighs 7½ oz. and was fired from a gun of .492 inch diameter, with 4½ oz. of powder. A similar bolt from the same gun passed through two plates, each 2¼ inches in thickness. These plates still remain on the desk at our office, and may be seen by any one interested in such matters.

We have a full description of the gun by which this extraordinary penetration was produced, but out of consideration for the interests of the Naval service we refrain from publishing it at the present time.

THE LONDON EXHIBITION—STEEL MANUFACTURE.

Never before has such a splendid collection of different specimens of steel been witnessed as in the Exhibition Building. Excepting the very small quantities of native steel made in Asia, all the finer qualities, with limited exception in France, are manufactured in England. This is not owing to the possession of superior iron or coal for the purpose (because the best iron used comes from Sweden), but to acquired skill from long experience and careful manipulation. Steel differs from cast iron in being capable of forging and welding, and it differs from wrought iron in being capable of casting, hardening and tempering. It is the strongest metal in the world, and the best adapted for all kinds of cutting instruments. Steel is essentially iron containing a very small quantity of carbon—about one per cent—and a minute trace of nitrogen, which, some assert, gives it the peculiar quality of tempering.

Thus, if a piece of steel be heated, say to low redness, and then rapidly cooled by immersion in water, it is rendered extremely hard and brittle; but if this hardened steel be strongly reheated and afterward left to cool slowly, its original softness will be restored. In the process of reheating, the surface of the metal acquires a succession of well defined tints, beginning with pale straw and ending with deep blue, the former corresponding to the lowest and the latter to the highest temperature. If pieces of the same kind of steel be heated so as to acquire respectively this succession of tints, and then instantly plunged into water, they will be found to possess different degrees of hardness corresponding to the different tints. It is in this manner that steel is tempered. Steel is more fusible than wrought iron, and may be melted in ordinary furnaces, when it is termed cast steel. Steel may be welded to steel, or to wrought iron, under suitable conditions.

Two processes are employed in obtaining steel. One consists in extracting a certain quantity of carbon from pig iron; the other in adding a certain quantity of carbon to wrought iron. The finest steel is obtained by the latter process. The common method is by cementation, which consists in exposing flat bars of iron imbedded in charcoal to about the temperature of melted copper during many days. Carbon thus travels into the very center of the bars. The furnaces are termed "converting furnaces," and the bars produced are called "blister steel," from their being studded with blisters like protuberances. The other method of making steel by extracting some carbon from pig iron, consists in exposing melted pig iron to the action of a blast of atmospheric air at a high temperatue in a charcoal hearth. This has been called "natural steel;" and the process is quite old. Another method for producing what is called puddled steel, consists in blowing air through molten pig iron in a ladle, then adding some specular pig iron. The latter has been called the Bessemer process, and is practiced as follows:—

The melted pig iron is allowed to flow from an adjoining cupola furnace into the "converting vessel," which is a circular vessel of iron coated internally with a refractory lining of silica. Several jets of air are then blown in at the bottom and bubble up through the metal. The temperature gradually increases, and at length a small volcanic eruption suddenly occurs, melted scoriæ being projected on all sides with great violence. But soon all is again tranquil, and the chamber, it is asserted, contains malleable iron in a state of perfect liquidity. This may be tapped out into molds, and, with special precautions, drawn out into bars, &c.; but it is apt to be cellular and unsound.

Some spiegeleisen (specular pig iron made from Franklinite in Germany) is now introduced into the molten iron, in which it dissolves like sugar in water. This pig iron contains a known quantity of carbon, which is imparted to the molten iron, and converts it into steel. Iron which contains phosphorus cannot be advantageously converted into steel by this treatment. All that is used for the purpose is made from good hematite ores. Steel can also be made by melting granular pig iron with the oxide of iron in a crucible; also by melting scrap iron with charcoal powder, and some of the oxide of manganese in a crucible. All steel is called cast steel after having been melted.