SUBMARINE WARFARE.

The following extremely interesting article is cut from the *London Review*, and will fully repay attentive perusal:—

Few things in the present American conflict have been so much spoken of, and have produced such small results as the much-dreaded "torpedoes." One, several weeks ago, was exploded in Charleston harbor, under the bows of the *Ironsides*, raising a wave which swept her deck, and extinguished the engine fires, but without injuring the hull. Another, early in the present year, exploded under a transport in the Yazoo river, and destroyed her. But though the Confederate coast, harbors and rivers have been described as thickly planted with these agencies of destruction, and many enterprises have been abandoned by the Federals out of sheer terror of encountering this unknown danger, these are almost the sole instances in which any practical result has been effected. This indeed was admitted by Captain Maury in the course of the discussions at the late meeting of the British Association. Our own experience in this species of warfare is somewhat similar. We have never indeed, attempted stationary explosive vessels, for the sufficient reason that we are not in the habit of standing merely on the defensive, the only situation in which they would be serviceable. But when we sought to attack the French flotilla at Boulogne by means of catamarans, as they were called—vessels about 21 feet long by 3 wide, filled with 40 barrels of gunpowder, loaded till they just floated level with the surface, and fitted with clockwork to cause the explosion any given number of minutes after being cut adrift and sent with the tide among the enemy's vessels—only one proved effective, the rest blew up harmlessly in the midst of the hostile fleet. So when, a short time before, Lord Cochrane prepared in the Aix roads five "explosion vessels," filled with 1,500 pounds of gunpowder, and strewn over with thousands of shells and grenades, only one performed its work properly, though in that single case the violence of the shock was so great that it broke into fragments the massive boom which guarded the harbor, and drove the French in terror from their ships, while the wave it raised almost swamped the gallant author of the device in the small boat in which the crew were pulling for their lives from the vessel after the fuse had been lighted. Perhaps, therefore, even in the case of a war with Russia, we need not feel any very great alarm at the new defences with which Cronstadt is being surrounded, which consist, according to the last advices, of numberless torpedoes, each containing 70 pounds of powder, sunk in the channel; and of a mysterious submarine boat, composed of 200 tuns of iron and steel, which is to attack our ships in that part which in them, as in the human subject, is least capable of defence.

The Confederate devices differ from these antiquated arrangements in other respects beside the fact of their being stationary. Our explosion vessels and cata marans were intended to explode on the surface, or immediately under it, and at a fixed period after being fired; while theirs are submerged, and intended to explode on being touched by the hostile ship. But whether it is that the machinery for this purpose is too delicate, and becomes easily deranged, or that the body of water between the shock and its object deadens the effect, the result seems singularly ineffective. A new agent, however, is likely to be soon introduced which may modify this result. It has been ascertained that gun cotton, properly prepared, will act with immense violence through a distance of several feet of water. It possesses a quality which can be given to gunpowder only in a very limited degree, of having its rapidity of inflammation and consequent mode of action very easily modified to suit the special purpose for which it is designed. It may be made either to explode slowly, and, as it were, progressively, or instantaneously. Now this difference produces very different results. A slow explosion is best fitted to lift heavy masses, as in mining, or used in large guns; a rapid one is most effective in shattering in the immediate neighborhood. Thus several ounces of gunpowder may be fired upon a porcelain plate without injuring it, but a single drop of nitrogen will grind it into minute fragments. Gunpowder, indeed, when used in large quantities, even in the open air, will destroy what it touches, for the *inertia* of the large body of air which must be moved by the liberated gases drives their effect in part against the more solid obstacles in the neighborhood. Thus the gate of a fortress may be blown in, as that of Delhi was, by the explosion of a bag of gunpowder nailed against it. And no doubt if such a bag could be brought immediately against a ship's side, it would be as easily stove in. But the interposition of the water supplies a buffer; the explosion has rather the effect of strong and sudden pressure than of a blow; its effect is not so rapid but that the water can move partly out of the way, and in communicating to it this motion, the power of the gunpowder is lost. Gun cotton, however, when specially prepared and confined in a box, explodes with an instantaneous action, almost equal to that of chloride of nitrogen; the water has not time to move away, and the blow is thus transmitted sharply, as by an iron striking one end of an iron rod. So it is possible that this new explosive material may render "torpedoes" hereafter a little more lively and active than they have yet been.

Meantime, however, some experiments conducted last year by the officers of the *Excellent*, at Portsmouth, which have just been published in the Appendix to the Report of the Ordnance Committee, open a new field for speculation. It is well known that if a gun be fired while its muzzle is a few inches under water, it will burst, the reason being that the impetus acquired by the gases is brought to a sudden check by the resistance of the water, and before the water can move away the blow has burst the piece. But if the gun were wholly submerged, this reason would not hold, for there would then be no sudden check, and the immobility of the water would be gradually overcome while the combustion of the powder proceeds, having much the same effect as double or treble shotting the gun. The proposal has, therefore, often been made that we should try the effect of a gun thus fired under water, but it has not till now, so far as we know, been put to decisive proof. The experiments at Portsmouth were conducted in this manner. A stage was erected in the harbor within the tide-mark; on this an Armstrong 110-pounder was mounted, loaded and aimed, at low water, at a target placed also within the rise of the tide. When both gun and target were covered by the water to a depth of 6 feet, the gun was fired by means of a tube. The targets were placed at from 20 to 25 feet from the muzzle of the gun. One was composed of piles and oak planking, of a thickness of 21 inches; another consisted of the hull of an old vessel, the *Griper*, laid on a mudbank; a third was made up of 3 inches in thickness of iron boiler plates, bolted together, and packed with timber. On all these the effect of shot and shell from the submerged gun was very startling. The wooden target was pierced through and through; the iron target was broken into pieces and driven into the packing, the solid shot passed right through both sides of the vessel, making a huge hole through which the water poured in torrents; a shell with percussion fuse burst in entering, opening a chasm of 5 feet by 3 in the planking, shattering the ribs, and bursting up the deck beams above.

It is impossible to foresee the full consequences of these most important experiments in the naval war and ship-building of the future. But that they must be very material is beyond a question, if we only remember that hitherto we have been content to cover with armor only the portion of our vessels which is above the water line, or a few feet under it, in the belief that no shot could take effect lower than "between wind and water." This, no doubt, was the case both with the old spherical shot, and the Armstrong conical shot, for both ricochetted when they touched the surface of the water. Mr. Whitworth's flat-fronted shells and shot certainly enter the water, and are effective after passing through it for some 20 feet, but as their form causes them speedily to lose velocity, and as, if fired from the surface, they must pass obliquely through a considerable distance before attaining any great depth, they are not likely to prove very dangerous at more than a few feet in depth below the water line. But the new submarine firing may obviously be equally effective at 10 or 20 feet as at 6 feet under water, and consequently the whole hull must be armored to resist it. What thickness of armor may be requisite for this purpose is yet to be determined. But any armor, even the thinnest, involves a great addition to the weight of the vessel, and must very seriously effect all questions regarding their size and form. And, indeed, it may well be doubted whether we shall be able to build any vessel, with stowage capacity, which shall be able to bear this additional weight. Certainly, at once, we may consider all ships with mere wooden hulls, like the *Royal Oak*, or those new vessels which Lord Palmerston insists on our laying down in order to use up the dockyard store of timber, and which Mr. Reed is accordingly now designing, as placed *hors de combat* by the last novelty in the art of gunnery.

It will have been seen that we do not anticipate any serious difficulty in the way of its practical application. Our mechanics, and those of other nations, are quite ingenious enough speedily to devise for self-opening and self-closing submarine ports, from which a gun may send its contents into its opponent's hull. For ha defences, guns placed permanently below water in the channel, and fired by a galvanic battery on shore, when the hostile ships are overhead, are an obvious method of applying the principle, and probably would be far more effacious than any self-acting torpedoes. But even without any mechanical appliance, is it impossible for sailors to sling a heavy gun, ready loaded, overboard, and fire it by a tube or wire as they run alongside the enemy? Innumerable questions of this character will rise from these preliminary Portsmouth experiments. But while waiting for their development and solution, it cannot at least be denied that the discovery of means by which the old peril of a shot between wind and water is converted into the peril of a yawning chasm made three fathoms below the surface; while the later application of horizontal shell firing, directed against the hulls beneath, opens up a new epoch in the science and art of naval warfare.

Two Great British Armor-Clads.

During the third week of December last, the *Hector* and the *Achilles*, two great plated frigates, were launched in England. The *Hector's* tunnage, builder's measurement, is 4,123 tuns, but it is in reality 6,400 tuns; she draws 19 feet 8 inches in water; her armor consists of iron plates $4\frac{1}{2}$ inches thick, fixed on a teak layer 8 inches thick, sheathed on the back with $\frac{3}{4}$-inch iron plates, resting upon an inner backing of 10-inch teak; being a thickness of $23\frac{1}{4}$ feet. She carries twenty-four 68-ponnder smooth-bores, and six 110-pounder rifled Armstrong's on her fighting deck. On her upper deck she has four 110-pounder rifled Armstrongs, which can be used broadside, or bow and stern; also two 20-pounder rifled Armstrongs; one 9-pounder rifled Armstrong; one 12-pounder ditto field-piece, and one 6-pounder brass smooth-bore, for boat and shore service, She is also fitted to act as a ram, and has nine water-tight compartments. She was built for speed also, but in this she is a failure. The utmost that could be screwed out of her on trial was 12 knots, her main speed being 11·448 knots (13 miles), in making which she buried her nose in the water. Her ventilation was found to be "fearfully faulty," the temperature being rendered very cold everywhere, except in the stokers' compartment, where it was 130 degrees. The *Achilles* is 6,080 tuns; she draws 20 feet of water; her armor-plates are of rolled iron, $4\frac{1}{2}$ inches thick, tapering to a minimum thickness of $2\frac{1}{2}$ inches, with a teak backing of 18 inches. She has armor bulkheads, to prevent the ship from being raked fore and aft, and it is proposed to put a rifle tower on her upper deck. She is pierced to carry 46 guns on her main deck, with four Armstrong pivot-guns fore and aft on her weather deck. Her port sills are embrasured, giving each gun a play of 90 degrees. She is far superior to the *Hector* in sailing qualities, and can do 16 miles (14 knots) an hour without difficulty. More speed can be got out of her if necessary.

THROWING OLD SHOES.—The officers of a Massachusetts regiment, which recently encountered the rebels in the Shenandoah Valley, were much surprised at the peculiar noise made by the enemy's cannon. Upon investigation it was ascertained that the rebels had not fired either shot or shell, but had used instead pieces of railroad iron, and old horseshoes fastened together with telegraph wire.

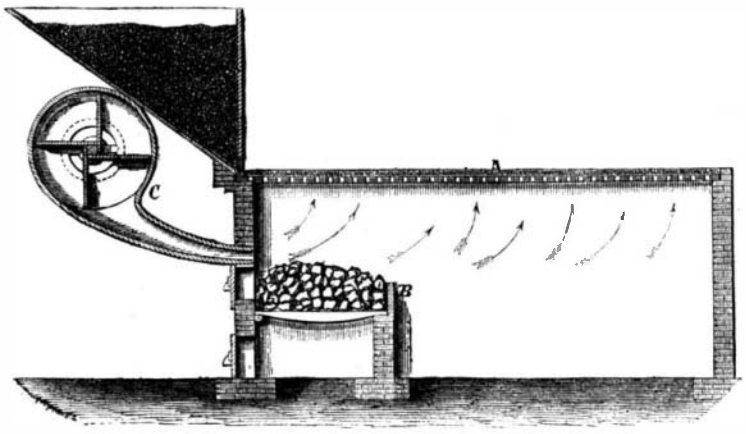
IT is the law in Japan that no fir or cypress tree can be cut down without the permission of a magistrate, and for every full-grown tree that is felled a sapling must be planted.

Improved Hot Blast Grain Dryer.

This engraving represents another method of drying grain, differing in some respects from the plans of the inventor, Mr. S. Marsh, before published on page 49, present volume of the SCIENTIFIC AMERICAN.

This arrangement consists in spreading grain in thin layers on a horizontal perforated metallic table, A, said table being placed over a furnace, B, the hot air from which is driven upward through the grain by the blower, C. This furnace may be dispensed with where a steam engine is employed, as the heated air from the boiler furnace may be caused to pass directly under the table and so impart its caloric to the damp grain. The hopper, D, contains a supply of grain, which, as fast as that upon the table is removed falls down, and may be spread out to dry with but little trouble.

As an expeditious and simple method for effecting the object, this plan is certainly an excellent one, as the large heating surface derived from the great area of the table permits the moisture to be driven off rapidly. The invention was patented on Jan. 16, 1863, by Sylvester Marsh. For further information address the inventor at Box 3047, New York city.



MARSH'S HOT BLAST GRAIN DRYER.

Henry Cort, Inventor of Iron Puddling.

The following interesting sketch of Henry Cort is taken from Smiles's "Lives of the Iron-workers and Tool-makers":—

Henry Cort was the great systematizer of the iron manufacture. He relinquished his business as a navy agent about the year 1775, and took the lease of certain premises at Fontley, near Fareham, at the north-west corner of Portsmouth Harbor, where he erected a forge and iron mill. The improvements embodied in his two patents of 1783 and 1784 were of a most important character. In the first patent he describes his method of making iron for "large uses," such as shanks, arms and palms of anchors, by piling and faggoting; that is to say, by welding together bars of iron of suitable length, forged on purpose, and tapering so as to be thinner at one end than the other. These bars were laid over one another like bricks in a building; the faggots so prepared were put into a common air or balling furnace, and when at a welding heat they were brought under a forge hammer of great size and weight, and forged into a solid mass of iron. He also notices the process of working the faggots by passing them through rollers, which was employed by him for the purpose of cleansing the iron and producing a metal of purer grain. Cort's second patent relates to his improved method of manufacturing bar iron from the ore or from cast iron. This method was a happy combination of processes practiced before his time; he employed the reverberatory or air furnace, without blast; and, he worked the fused metal with iron bars until it was brought into lumps, when it was removed and forged into malleable iron. The bottom of the reverberatory furnace was hollow, so as to contain the fluid metal introduced into it by ladles, the heat being kept up by pit coal or other fuel. When the furnace was charged, the doors were closed until the metal was sufficiently fused, when the workmen opened an aperture and worked or stirred about the metal with iron bars, when an ebullition took place, during the continuance of which a bluish flame was emitted, the carbon of the cast iron was burned off, the metal separated from the slag, and the iron becoming reduced to nature, was then collected into lumps or loops of sizes suited to their intended uses, when they were drawn out of the doors of the furnace. They were then stamped into plates, and piled or worked in an air furnace, heated to a white or welding heat, shingled under a forge hammer, and passed through the grooved rollers after the method described in the first patent. As there are not fewer than 8,200 of Cort's furnaces in operation at the present time in Britain alone, we need not speak of the great advantages of his system of conversion. His great merit consisted in apprehending the value of certain processes as tested by his own and others' experience, and combining and applying them in a more effective practical form than had ever been done before. This power of apprehending the best methods and embodying the details in one complete whole, marks the practical, clear-sighted man, and in certain cases amounts almost to genius. The merit of combining the inventions of others in such forms as that they shall work to advantage is as great in its way as that of the man who strikes out the inventions themselves, but who, from want of tact and experience, cannot carry them into practical effect. The reward which poor Cort received for having done so much to develop the great resources of his country was—ruin. He was made answerable for the defalcations of Adam Jellicoe, the deputy-paymaster of seamen's wages, and father of his partner, and had to give up his works. After a hard struggle with want, he obtained a pension of £200 a year for the support of his destitute family of twelve children. "In the opinion of Mr. Fairbairn, of Manchester," says our author, "the inventions of Henry Cort have already added six hundred millions sterling to the wealth of the kingdom, while they have given employment to some six hundred thousand working people during three generations. And while the great ironmasters, by freely availing themselves of his inventions, have been adding estate to estate, the only estate secured by Henry Cort was the little domain of six feet by two, in which he is interred in Hampstead churchyard."

How Statues are Made.

A correspondent of the London *Reader* gives the following details regarding the production of statues:

"The sculptor having designed a figure, first makes a sketch of it in clay a few inches only in hight. When he has satisfied himself with the general attitude, a cast is taken of his sketch, and from it a model in clay is prepared of the full size he designs for his statue, whether half the natural hight, or life-size or colossal. The process of building the clay, as it is called, upon the strong iron *armatura* or skeleton on which it stands on its pedestal, and the bending and fixing this *armatura* into the form of the limbs, constitute a work of vast labor of a purely manual sort, for whose performance all artists able to afford it employ the skilled workmen to be obtained in Rome. The rough clay, rudely assuming the shape of the intended statue, then passes into the sculptor's hands and undergoes his most elaborate manipulation, by which it is reduced (generally after the labor of several months) to the precise and perfectly-finished form he desires should hereafter appear in marble. This done, the *formatore* takes a cast of the whole, and the clay is destroyed. From this last plaster cast again in due time the marble is hewn by three successive workmen. The first gives it rough outline, the second brings it by rule and compass to close resemblance with the cast, and the third finishes it to perfection."

Formosa Camphor.

The manufacture of this article has for some years been monopolized by the Taotai (or Head Mandarin) of the island, and its sale farmed out to wealthy natives. In former years a good deal of the drug was clandestinely produced, and smuggled across to China, where it was largely bought up by foreign speculators and carried to Hong-Kong for shipment to Calcutta, at which place it finds the readiest market, being used by the natives of Hindostan for lubricating the body and other domestic purposes. But now its monopoly is so closely watched that almost the entire trade in it falls to the lucky individual whose Chinese agents can secure the monopoly. This bad system has occasioned the price of the article in Hong-Kong to increase considerably in value, and to make the profits accruing to the fortunate monopolist almost fabulous.

The cost of the drug, I learn, amounts to only six dollars at its place of manufacture. The monopolist buys it from the Mandarin at sixteen dollars the pecul and sells it in Hong-Kong at twenty-eight dollars. The gigantic laurel (*laurus camphora*) that yields the camphor, covers the whole line of high mountains extending north and south throughout Formosa. But as the greater part of this range is in the hands of the aborigines, the Chinese are able to gain access only to those parts of the mountains contiguous to their own territories that are possessed by the more docile tribes. The trees, as they are required, are selected for the abundance of their sap, as many are too dry to repay the labor and trouble of the undertaking.

A present is then made to the chief of the tribe to gain permission to cut down the selected trees. The best part of the tree is secured for timber, and the refuse cut up into chips. The chips are boiled in iron pots, one inverted on another, and the sublimated vapor is the desired result. The camphor is then conveyed down in carts of rude construction, and stowed in large vats, with escape holes at the bottom, whence exudes an *oil*, known as camphor oil, used by Chinese practitioners for its medicinal properties in rheumatic diseases. Samples of this oil have been sent home, and it may eventually become a desideratum in Europe. From the vats the camphor is stowed in bags to contain about a pecul each, and is thus exported. The Chinese Government has empowered the Formosan authorities to claim on its account all the timber produced by the island for ship-building purposes; and it is on this plea that the Taotai appropriates the prescriptive right of dealing in camphor. About 6,000 peculs of the drug are annually produced in the neighborhood of Tamsuy.—*Robert Swinhoe.*

Granada Cotton.

We have received from E. Flint, M. D., of Granada, Nicaragua, one sample of the native cotton of that country, and two different kinds of cotton seeds, which he collected in the mining part of that State. The color of the cotton is a buff, and darker in the shade than the yellow variety of Nankin. It remains unaltered by washing and is used by the native Indians in manufacturing their common hand-made, coarse cloth. The fiber is coarse and short, but very strong, and it will make a durable quality of cloth. Dr. Flint states that the seeds are of the white variety of cotton, which is prized on account of the facility with which it parts with its seed, thus rendering it very easy to gin. Each head or boll of cotton contains from three to five kidney-shaped seeds, arranged almost like the grains on a short, thick ear of wheat, and it is called the kidney variety on account of the shape of the seeds. The buff-colored cotton will grow in a colder climate than the white variety.

A NEW ISLAND IN THE MEDITERRANEAN.—A new Mediterranean island has come to the surface, off Palermo. It is a volcanic phenomenon, and appeared for the first time a few years since, and was taken possession of by the Neapolitan Government and named Fernandia, but disappeared one fine day and sank to the bottom, and has just come up again to the great delight of the scientific world. An English vessel, with several members of the learned societies on board, has just anchored off Palermo to take observations, which cannot fail to be of great scientific interest.

IN cargoes of ice, which have been shipped from Boston to the East Indies, have frequently been placed considerable quantities of apples, which have reached their destination in as good condition as when first shipped.