

A Visit to the Iron-clad Ship.

THE birth-place of the *Warrior* is in the same land, or amphibious region, where the *Great Eastern* was reared in its mighty hulk. It is a strange country, where mud and water seem to be of much more value and importance than solid land; and the houses are all not only mere brick cabins, but they are dwarfed by the tall masts of ships that tower above every thing, and in the most impossible-looking situations. Here and there you see a ship, perfect as a model,—perhaps a Yankee barque,—with her slender sticks tapering high into the air and all her rigging as fine and neat as spider's work, mounted up far above the houses. She is in a dry-dock, to be made all tight and smooth for her next run across the Atlantic. Whichever way you look the eye falls upon forests of masts, with here and there a tall chimney sending out a curling line of dark smoke or white clouds of steam; and if you stop to listen when you land from the Blackwall railway, you hear on every side the sharp quick hammering of the riveters, the heavy thump of steam-hammers, with a general hum of hoarse voices, that tell at once of a very different occupation from those of the busy crowds who throng the Strand and Fleet Street. The people, too, are all of another kind; those that are not unmistakable sailors have the peculiar cut of men who deal with iron and steam and machinery. Their dress, from head to foot, is made for service; close fitting head-gear, short handy jackets, and no unnecessary outriggings,—nothing to hinder their passing between awful fly-wheels, the slightest brush from which would be certain death,—and generally of material that both repels the sparks from heated masses of metal and protects the wearer from the tremendous heat. There is something singularly attractive and interesting in these sons of Vulcan. They follow a perilous trade, and their familiarity with the great powers generally confers a kind of nobleness and independence of spirit, which, beyond their constant superiority of intelligence in their class, gives them the manners of an aristocracy of their own. It is impossible not to feel a great admiration for the engineer who drives an express train, with the lives of hundreds depending on his keen eye, his clear head, and steady arm; or for the sailor, cool, strong, and dauntless against the raging gale and merciless ocean. In these extreme emergencies we feel the value of such men. And these are the men who make and work our *Warriors* and *Black Princes*.

But we must hasten past the docks behind the railway-station,—where a magnificent old Indiaman lay alongside, sending his great bowsprit right over the roadway, and a tight little Dover mail-boat, looking wonderfully yacht-like, and fragile as a nautilus, yet a gallant and daring little vessel in any weather,—till we arrive at the office of the Thames Iron

Ship-building Company. Here, while waiting in the ante-room, we had the opportunity of examining one of the armour-plates which had been fired at by 68-pounder round shot. It was a piece about two feet square, which had been struck by several shot, and broken completely into fragments; though none of the shot had actually pierced it, yet some had very nearly done so, and it was clear that had a second shot ever struck in the dent made, it must have gone quite through the plate. This, indeed, has occurred in practice at the targets.

Our party was now standing on the bank of what may be called Lea Creek, waiting to be ferried across in the workmen's boat. The *Warrior* was before us, lying in a side cut on the opposite bank, and her huge hull of iron, all painted red and covered with scaffoldings, rose up as high as a five or six storied house. Landed on the mud-banks, we passed through the timber-yard, where the men were squaring up the large ribs, or rather pectoral muscles, of teak, each nine inches thick, which are placed in two ranges, one across the other, to support the armour-plates; thus making eighteen inches of the strongest timber outside the iron skin of the ship. This wood cushioning, it is thought by some, will act as the man-at-arms' suit of buff did in deadening the blow upon the skin; but, on the other hand, it has been suggested that, according to the experiments made on wooden targets, a yielding material like wood has been the cause of more injury being effected by shot than if the armour-plates had been bolted on in immediate contact with the iron supports which would represent the ribs of a ship. Approaching the side of the ship, workmen are seen clinging on to her in almost every spot; some are carpenters at the ports, finishing the wood-work and fitting the ribs, but most are iron-workers; and the din of hammers is so loud that we are obliged to shout as if in a gale of wind. We creep along under the scaffoldings, over the mud every now and then, scared by a shout of "Below there!" when down comes a heavy rivet or bit of plate; so that it is not without certain casualties that this sort of work can be looked at even. But the men go on quite unconcerned, many of them seated all day on a wet plank close to the mud, pulling at the handle of a drill with the same kind of action that a rower uses: in this way the iron is pierced for the bolts when in its proper position. The immense stern-post is fastened on to the keel-plate by long arms of iron, extending about twelve feet on each side the keel, and then drilled and bolted on. But she has no regular keel as ordinary ships have; the ribs are fastened to a keel-plate which is $1\frac{1}{4}$ inches thick; and to compensate for the want of a keel, and counteract rolling when afloat, long projecting flanges, called bilge-pieces, about a foot deep, are fixed along the bottom midway between her water-line and keel-piece. This is according to the design of the ship by the Surveyor of the Navy; and it should be understood that the *Warrior* is entirely built upon plans and drawings and calculations furnished by the Admiralty; although I believe, on very many points, it has been found necessary to correct these, and we must not be too hard upon Sir Baldwin

Walker in his first experiment. Whether it was wise to follow the model of a floating battery in setting out the lines of a ship intended to be a fast frigate, capable of taking the sea in all weather, is a question. In my opinion, the bilge-pieces can never give that steadiness in a sea-way and handiness in steering that a keel does; they appear to have been an after-thought, as the best thing that could be done when it was too late to build the ship with a keel. This little mistake is much to be regretted, however, and not the less so as we know that the Emperor Napoleon's naval architect, M. Dupuy de Lôme, has adapted armour-plates to wooden ships which have a regular keel; and of these *La Gloire* is reported to possess very good qualities both in speed and sea-worthiness. This, however, as will presently be shown, there are some reasons for questioning.

But now let us stand under the stern of the ship, just where, when she's afloat and moving through the waves, her huge tail-fin will work like the flukes of a great whale, and force-on the vast leviathan of 9000 tons. Looking upwards at this stupendous piece of forge-work the stern-post, which goes right away to the upper deck, more than forty feet high, one is struck with the same kind of wonder as in viewing any of the grand effects of natural forces,—the upheaving of a mountain of slate or the twisting off of the largest forest-oaks as if they were green withies. How the hand of man could have been brought to bear upon such an enormous mass of the toughest iron! Steam and machinery have done it of course; but how to get these obedient forces to shape and model that enormous ring of metal near two feet thick, and to weld it on with the immense iron post that has its strong roots in the keel, and its branches above in the framing of the ship! Yet there it is, as neatly formed as the most delicate frame for a pair of spectacles. It took thirteen months of ceaseless forging to get this gigantic limb of the *Warrior* into shape. Night and day it was kept glowing in the furnace, and anxiously watched as it was lifted out slowly by steam-power and brought under the Nasmyth hammer, again to be returned to the fire, and so on until the Vulcanides completed their triumph. Some idea of the powerful mechanical appliances employed may be got when we learn that the weight of this piece of wrought iron is forty-three tons; and the success of the work is a capital instance of bold English enterprise, for it is the largest forging ever made. The stem is an almost equally fine piece of forge-work; it is more than twenty tons weight, and well shaped for cutting through the water. The forging of the enormous screw-shaft, which will have to work through the ring in the stern-post is another undertaking of scarcely less difficulty; though, as to this, at these works they seem to think no more of these huge screw-shafts than a poor turner does of his broom-handles; they lie about waiting to be shaved by the planing-machine, under the care of one man, who whistles and sings at his easy task, not at all like one who is wielding the power of some hundreds of horses.

It should be borne in mind that these iron stern-posts are a most important feature in the new men-of-war. The strain upon the wooden stern-

posts in some of our fastest and finest ships, like the *Orlando* frigate, for example, is so enormous, especially whenever the speed is forced at all, that the whole fabric of the ship trembles and shakes to such a degree, that the vessel would soon be rendered unfit for service; even the topmost spars feel the shake in these vessels of very great steam-power. Therefore, in modern naval warfare, as great steam-power—*grande vitesse*, as our neighbours have it—will be indispensable, we must have iron stern-posts, and no doubt also iron ships. Nothing else will stand the tremendous strain of the screw; and if ships-of-war are to be made shot-proof, the whole skeleton of the ship must be of iron as well as the muscles and skin. The Emperor Napoleon, it will be found, has a little over-reached himself, and perhaps hurried his able architect M. de Lôme, in converting his ten good wooden ships into cuirassed frigates à *grande vitesse*. Shot-proof they may be, but they can never stand the shake of the screw and remain weather-proof for any thing like the time that iron ships can. In my view of the matter, we shall see these *frigates blindées*, about which so much fuss has been made, laid up at Toulon and Cherbourg like our Gog and Magog at Guildhall, while M. de Lôme tries his hand at an iron ship on an improved model, after our *Warrior*. It is known, indeed, that extensive preparations have been started for constructing iron ships like the *Warrior*, so that our French friends are now the copyists.

Before going on board the ship, it should be noticed that her sides are as upright as the side of a house, and the line of port-holes not unlike eighteen square windows, about ten feet from the water-level. Thus she will, if she ever meets an antagonist, make a splendid target; every shot will be received in the best possible manner for penetration, and there will be no glancing off. This point in her form has been much and very justly objected to, partly because the sides are unnecessarily exposed, but chiefly because the great weight of the armour-plates, being thus carried at a disadvantage, will sway the ship from side to side in any thing like rough weather, and thus render her, not only very difficult to manage, but, in case of coming to blows, very inefficient in gunnery. Captain Ford, the superintending naval architect at this yard, has constructed a model for an iron ship in which the sides slope inwards from the water line, and thus the weight of the armour is brought to a nicer balance upon the centre of gravity of the ship. This appears to be a most important consideration in the building of these iron ships carrying armour on their sides. The Admiralty, with worthy Sir John Pakington at their head, went to work a little too much in hand-over-head style; there would have been nothing *infra dig.* in asking the advice of professed iron ship-builders before the *Warrior* was commenced; indeed, if two years ago they had only done as the Russian Emperor has, given a *carte-blanche* to two or three of our great iron ship-builders, we should by this time have floated two iron frigates that *could* fight in any weather.

You may step through a port without much stooping, and so on to the main-deck. If a battle were raging, the scene could hardly be one of

more strife and noise; heavy blows resound on every side, and it requires rather a sharp look-out to avoid getting hit as you pass by some stalwart hammerer fighting with all his might against an obstinate bolt. Hoarse and angry shouts from the men are answered by shrill cries from the boys, who, armed with long pincers, rush madly past you with red-hot bolts, and take flying leaps over dark bottomless-looking abysses, like so many young imps. You look down these deep chasms, and the ship appears to be on fire in fifty places, and this gives the whole scene a strange character of wild and imposing fierceness and power; one feels that nothing but the terrible exigencies of war could call up such tremendous efforts, half demoniac in their energy.

Every thing on the fighting-deck of the *Warrior* is iron except a thin layer of wood laid over the iron, which forms the flooring; overhead are the great girders, made of Butterby's beam-iron, which span across the ship, and at the sides are the strong ribs. The space between decks is high enough to allow the tallest man to walk with his hat on without lowering his head, and a marine of the standard height might shoulder arms with fixed bayonets. This deck is completely shut off from the bows and stern of the ship by immensely strong iron bulkheads, and the parts beyond these are filled up with compartments formed like the tubular bridges. The object of these is to meet any injuries that may be done to this part of the ship, which is not invulnerable, the armour-plates being placed only as far as the fighting-deck extends. One naturally asks what is to become of the *Warrior* if the enemy should be so malicious as to give what, in pugilistic science, is called a foul hit—a blow below the belt. Achilles was conquered at last by a sly blow at his heel; if our *Warrior* were to be well peppered with round shot and shell in the tender parts,—if the vulnerable part of the stern were to be made the point for breaching,—the question is, whether the heavy stern-post would not tear itself away, and thus effectually cripple the ship. The reason given by the naval architects for not continuing the armour-plates all over the ship is, that if that were done, she would not sail; she would be like a horse weighted with his load on his head and his tail, and so, instead of mounting over the waves, she would probably prefer to duck under them. The defect is again an awkward one, and it will have to be mastered if iron ships-of-war are to form the navy. The protected part of the *Warrior*, then, is very little more than half the exposed surface of the sides, the total length being 420 feet; 214 feet of this space in length, and twenty-seven in depth, extending five feet below the water, represents the armour-covered part. The upper deck, which is fifty-eight feet broad, and substantially formed of iron plate three-eighths of an inch thick, covered with planking, is not consequently shot-proof.

The making of the armour-plates is quite as wonderful, simple as they look, as the framing of the ship. Iron of the best kind, it has now been decided, answers better than any kind of steel. It has often been

told how the French metal-workers had discovered some alloy of steel and another metal, the name of which was a great secret; this is now known to be all fudge, and the French armour-plates are simply made of the best iron procurable in France, and that very possibly is sent from our Staffordshire or Scotch furnaces. Cast iron would be of no avail against shot; therefore the metal is of the fibrous kind, obtained by drawing and rolling it out, by which means the crystallisation occurring during cooling is altered, and the metal gets the same strong properties which wire possesses. Enormous strength is obtained by rolling these into fagots of iron, as they may be called; and the best gun-barrels are made by coiling a long fagot upon a rod, and then welding the coils together: hence the name "twist," applied to the finest barrels and swords, such as those which come from Damascus and India.

Let us now enter the infernal regions, and see Vulcan forging the armour of Neptune. The first thing that attracts the eye is a huge wheel flying swiftly round half underground; it seemed to have no particular purpose as it went on and on, and one stood gazing in that state of fascination that any thing moving rapidly produces, wondering whether poor Ixion would turn up presently, and muttering the words of his fate—"se sequiturque fugitque"—to the tune of a mysterious kind of suppressed roaring, which seemed to come from below and made the ground vibrate continually. While lost in wonder as to what this wheel could be for, a deep loud voice behind shouts, in an uncommonly significant manner, "Look out there!" and our party is charged and scattered in no time by a handful of demonic-looking men, dragging a truck with a mass of red-hot iron hissing and glowing like a meteor. We were all standing upon one of the lines of rails along which this sort of volcanic transport service goes on night and day to the different furnaces, which are ranged about on every side. Nothing is more remarkable in going over great works of this kind than the way one mechanical power is brought to help another, until the accumulated result becomes developed in the completed design of some gigantic work, with which, in a direct manner, the hand of man has comparatively little to do, and which, indeed, it looks impossible it ever could have. Steam and the railway are doing wonderful things here with perfect ease and certainty, while in the days of the Pyramids it took thousands of slaves to put every single stone in its place. Three or four men stand at the furnaces (or ovens, as they look like); the chief-baker, a lusty fellow, opens the door and faces the fierce fire, armed with a large pair of tongs, with which he seizes and grapples with a lump of metal, turning it to see if it's well done on every side; his gang sway the chains of the strong crane overhead and get a firm grip on the mass, then to be swung on to the solid anvil, and kneaded into proper consistency, or perhaps shaped into some required form by the steam-hammer, which titanic implement, again, is as manageable as a child's toy. To a commoner the scene is rather alarming at first, when half a dozen of these Vulcanic batteries open fire, sending

their mimic shells and rockets about entirely regardless of broadcloth, and with no respect whatever for persons; the heat, too, is most scorching, and one is obliged to rush past the glaring mouths of the furnaces with shaded eyes, for none but the attendant salamanders could bear it.

The smaller lumps of metal that we saw being kneaded under the Nasmyth are thrown on the ground, and lie there in heaps like huge raisins from the vineyard of Brobdignag, and with just such a beautiful bloom upon them: the workmen seem to have caught this idea, too, for in this state the iron is always spoken of by them as "bloom." These pieces are next beaten together into lengths, and these again into still larger pieces, until at last the whole enormous plate of armour is got together—15 feet long, 3 feet wide, and $4\frac{1}{2}$ inches thick. In this condition you may see long ranks, packed on their edges like cards, waiting to be taken into the planing room.

Planing and sawing of wood by steam-power, as it goes on at Chatham dockyard, for instance, gives one some idea of the facility with which these processes now supply the place of many hands. The largest baulks of the hardest oak are ripped up without the least difficulty, so regularly and easily as scarcely to occupy the attention of the workman who tends the machine. In many of the great iron-works of the North iron is treated in the same way, and you may see large pieces cut up into slices for cog-wheels just with the same ease as a cook cuts up her carrots for a haricot. But the planing of such enormous masses as the screw-shafts of the largest ships, which require to be as true and smooth as watch-work, and these armour-plates, is a matter for which only a few factories possess the appliances. The machine which we are now supposed to be watching operates on two of the great armour-plates at once. They are placed edgewise upon a sliding bed, and being firmly fixed in front of the chisel, which is fixed in the frame of the machine, the steam-power is turned on, and the two plates begin to move slowly but irresistibly against the cutter; the workman merely stands by, seeing that a little soap-and-water trickles upon the metal to keep it cool, otherwise the tremendous friction would heat and soften his chisel, and render the process ineffective. The tough metal curls up before the tool in thick shavings, which come off as if the mass were nothing but a square of soap; but if you try to bend these shavings, you find it beyond the strength of your little hands. Sometimes the shaving is as thin as writing-paper and bright as silver, curling up like a lady's ringlet in the most fantastic shapes. This shows the excellence of the iron; bad metal would break off, and look dull in colour. Besides planing the edges flat, a deep groove is cut into them, to receive a corresponding slip of metal called a tongue. This is a recent improvement upon the armour-plating, and it is found to give a very important increase of strength, as well as preventing the cockling up of the ends or sides of plates when struck by heavy shot. It was found, in practice at the target, that if a plate was struck at one end, the opposite end was acted upon by a leverage of the plate itself,

and was thus displaced. This system has not been followed in fitting the armour-plates on the *Gloire* and *Normandie* French frigates; and the requisite machinery for doing it is as yet a little beyond the skill of our rivals in iron ship-building. According to the account given by Mr. Hussey Vivian, the armour-plates of the *Gloire* are very much smaller than any used for the *Warrior*, and they vary in size from 4 feet long by 1 foot wide, mere strips, to 5 feet by 2 feet 9 in., and larger. But this may be no more correct than his statement—which, by the way, is most of it hearsay—that the plates were of very superior iron, and six inches thick; a statement contradicted as soon as it appeared by Mr. Scott Russell, the builder of the *Great Eastern*, and an intimate friend of the Emperor's naval architect, M. de Lôme, who tells us they are the same thickness as ours, which we have just described, and simply of the best iron made in France, which is a very different thing. No doubt one of the reasons for using small plates was the difficulty in bending them to fit the different segments of the curved side of the ship; and this will occupy the skill of our iron-workers when the large slabs have to be fitted to the sides of the *Warrior*, a process which, taken in connection with the grooving and tonguing of one plate with another, will be a matter of considerable difficulty. This is reserved until after the ship has been launched.

When first the *Warrior* was contemplated, it was decided that she should have a sharp and strong iron prow, so as to be able to act as a steam "ram"—*belier à vapeur*, as the French translate it. This merciless expedient, however, has been abandoned, and the stem and cut-water of the *Warrior*, though strong and sharp, is not made for playing the old game of joust. Close by the *Warrior's* territory, however, a "ram" is being built, on the Isle of Dogs, like the *Warrior*, but smaller and much shorter, with the big head and beak, named already the *Resistance*.

Great speed, next to impenetrable armour, is the point in which we may expect to see astonishing results with iron ships. The *Gloire* can do thirteen knots; and, being a wooden ship, her lines have been easily modelled upon those which give such excellent qualities to the *Napoléon* and the *Algésiras* of the French navy. It is very questionable whether the *Warrior*, without any keel and with her long bilge-pieces, can be worked through the water at this speed, even with her two engines of 1250 horse-power, which is 250 more than the *Gloire*. The weight of the *Warrior*, rigged and fully equipped for service, with 1000 tons of coal, is nicely calculated at 8800 tons, drawing twenty-four feet aft; the *Gloire's* displacement is stated to be between 5000 and 6000 tons. The displacement of the *Marlborough*, 131, is 5400 tons, and her engines 800 horse-power; the *Duke of Wellington*, the *Howe*, the *Victoria*, the *Prince of Wales*, are all ships of this size, with engines of from 800 to 1000 horse-power.

The *Warrior* is to be rigged as an eighty-gun ship; while the *Gloire*

is what is called a fore-and-aft-rigged vessel, with short masts, gaffs, and booms, with the means of setting a square sail, if required. Very great advantage in lightness is thus obtained, by dispensing with many heavy masts and spars, which tend much to oppose the passage of the ship through the air as well as the water. This is one of the points of importance which have been overlooked in designing the *Warrior*; but possibly it is not too late to change her rig into the lighter form. It is indispensable that a steam-ship should be able to sail, as we have just seen in the passage of the *Ariadne* and *Hero* across the Atlantic; for if we suppose the *Warrior* caught in a fog, her week's coal consumed, and waited upon by an enemy having a reserve of coal,* she must inevitably be taken at a disadvantage, unless she could manœuvre to some extent under canvas. And this is another reason why greater attention should be paid to constructing iron armour-ships, not merely as impregnable batteries, but as thoroughly good sea-boats; and there appears to be no obstacle whatever to prevent their being made as fine models as the fastest frigates in the service. There are at least half a dozen yards that could turn out iron ships of this kind.

The reader has probably by this time learnt enough of the iron-ship question to agree in the decision which has been reported as that come to by the Board of Admiralty, viz. that the *Warrior*, and, of course, her sister-ship the *Black Prince*, are not all that could be wished, though they may turn out better sea-boats than is generally anticipated. In returning home, however, from our visit to the *Warrior*, it is natural that we should be chatting about the prospects for future iron men-o'-war. Jack makes a struggle, no doubt, at Whitehall, when asked to give up his trim-built frigate, with which all the glories of the service, all the traditional feats of arms that form the splendid yarns of fore-castle and gun-room, are associated. The age of chivalry for the navy is fled, indeed, when young England's sea-captains talk loudly of going to sea with a ship-load of Martello towers,—when the first question a man will be asked on his appointment to a ship will be, How many cupolas does she carry? The end of it all will be, that the guns will be worked by machinery from below, the whole crew being safe out of harm's way, full fathom five under water; and the gallant captain will be taking his sights of the enemy, either snugly ensconced in his bomb-proof cupola, or perhaps even lying on his air-cushion below, peering through a reflecting telescope, and whispering bland suggestions to his officers through a well-laid series of speaking tubes. As to manœuvring, chasing, getting the

* Coaling is another great difficulty in steam-warfare. In the French navy compressed artificial fuel has been introduced, with what particular advantages we are not informed; but it would seem that, both as regards stowage and the production of greater heat, some form of fuel might be discovered which would enable a steam-ship to extend her week's limit of steam-power. From 100 to 150 tons per day is an enormous consumption; and yet we cannot suppose the steam navy is behind our railways in taking every advantage obtainable by superheated steam and the smoke-burning apparatus.

weather-gauge, carrying on, going aloft reefing top-gallant sails, and a hundred other things that form the charm of a seaman's life,—all these will be confined to that delectable service, the suppression of the slave-trade. To say that any one who ever felt the glorious excitement of being on board a well-handled ship in a stiff breeze, even without the additional seasoning of a shot now and then flying through the rigging, can regard these "vast improvements" without a regret, would be saying very little for his sympathies with a splendid service, a noble life, and as fine a set of fellows as ever breathed. It is indeed a pity that the representative British Tar is a race doomed to become extinct; but that this will come to pass in proportion as ships of war are turned into floating fortresses, and the charm of danger banished, we must expect. Alas, that civilisation demands the sacrifice of our ancient pet!

It is sincerely to be hoped, whatever may be the discoveries of scientific naval architecture in iron, and of gunnery, that our men-o'-war will still be constructed to look as much as possible like ships. It is not to be supposed for a moment that our high-spirited youth of the aristocracy, and our race of seamen born on the shores of the island home, take to the sea for the sake of the fighting; that they would practise a profession of butchery and destruction from behind iron walls, living every day in a casemated black-hole, and taking so much a day of fresh air on the roof. Those who know any thing of sailors must see the charm of the life which animates them; and it is only surprising that any who confess their sympathy for the profession should be advocating the construction of engines (they cannot be called ships) devoted to all the grossness and barbarity of war, while they are deprived of every thing attractive to the sailor.

Let the new iron frigates be as invulnerable as iron and mechanical skill can make them, and let us, by all means, have a fleet of them ready without delay to match any that can be brought into the sea from other shores. But let them be ships that officers and men can take a pride in, as they ever have; let them still look smart, sail well, and steam well; as to the fighting, that's safe enough to be well done in any case.

R.

