IRON-CLAD SHIPS OF WAR.

"WHAT! put an engine and screws into the Royal Albert?" said, in 1849, the best of the naval shipbuilders in England, if not in the world. "Turn that ship, sir, into a steamer! Never while I live!" The Royal Albert was then on the stocks, and the Agamemnon's keel was being laid in Woolwich dockyard. Five years afterwards, that worthy old man was in his grave, and the Royal Albert was a screw three-decker, and flag-ship to Admiral Sir Edmund Lyons. The world will wag on in spite of the school of naval architecture. "What!" exclaim others to-day, as good and as true as Oliver Lang—"what! put our Benbows, our Hawkes, Nelsons, and Victorias into armour?—cover our heart-of-oak with iron, sir? Have a care!" Yes! alas! we say, good sirs, it must be so. Men of the sea, and men of the dockyards, may, like the worthy Canadian who first saw a vessel move under steam, throw up their hands to heaven, and exclaim, "Croyez vous que le bon Dieu permettra tout cela!" and yet the world will wag on. Gunnery, steam, rifled muskets and rifled cannon, have called into existence certain safeguards, such as stouter earthen and granite parapets, better mantlets, securer magazines, and lastly, iron plates to resist for a while the terrific strokes of Armstrong's and Whitworth's projectiles. The thick parapet, the mantlet of stout rope, the magazine deeply buried in the ground, are out of the power of sailors to adapt to their ships; but the iron plate—which is perfectly proof to shell, to hot-shot, to grape-shot, and to congreve rockets, and only to be penetrated, when overlaying an elastic substance, by the heaviest solid shot, thrown at the close distance of 200 yards—affords to our navy an amount of security equal to that found by soldiers behind their parapets of earth, or in granite casemated fortresses; not immunity, remember, but partial security. To the unprofes-ional inhabitant of the United Kingdom, the immediate adoption of these iron plates, as a security against some of the great risks of a sea-fight, would appear to be a natural and sensible measure. "Surely," he argues, "if it be found that the wooden sides of our ships, whether of oak or teak, no longer afford partial protection for the seamen at their guns against the strokes of Armstrong shells, at even a mile distance—and Whitworth boasts that his 3-pounder (which is about the weight of the grape-shot of the old 68-pounder gun) will likewise pass into a vessel at a greater distance—if it is known that an Armstrong's hundred-pounder shell, bursting at the water-line in the wooden side of a man-of-war, rends a hole that will assuredly sink her, in spite of all the shot-plugs in the navy—if a solitary red-hot shot, planted in a ship's side, sets her on fire—or if either it reaches, or a shell bursts in, the magazines or handing rooms, the entire ship and crew will be hurled into eternity—and it is found that a 4½-inch armour of wrought-iron materially reduces all these risks—it must be better to apply it, even should it not be entirely invulnerable, until some better invention is discovered. It may not be perfect," he would argue, "but it is a step in the right direction, and evidently an improvement upon wood alone." Our unprofessional man is simply rational upon this point of ship-armour, because he happens to be untrammelled with any preconceived notions upon the subject. It is far otherwise with the majority of naval officers and naval ship-architects. They are just as intractable upon the question of covering their wooden ships with armour as he (the landsman) would be if the matter were one of Puseyite innovation, church-rates, town-drainage, or municipal taxes. Bearing this in mind, therefore, let us not rail at the old and experienced seamen and shipwrights, who are so hard to convince upon the desirability of employing this new invention; but try to con-

vince them, by meeting all their objections, and by pointing out the proved and probable advantages of iron-clad ships over wooden ones.

We will first point out the causes that have called into existence this novel mode of protecting ships from the destructive effects of modern artillery. When the Russian war of 1854 broke out, there was a general opinion in naval circles, shared by ourselves, that a fleet of line-of-battle ships, manned with good seamen gunners, would batter down any fortifications, if it could be laid sufficiently close for the purpose—namely, at about three hundred yards' distance. If any one demurred to this opinion, and quoted the case of the line-of-battle ship that, in the Walcheren expedition, was beaten off by a couple of howitzers worked through a gap in a dike — or the severe punishment of the Pompée and Tigre, under the heroic Sir Sidney Smith, by a solitary martello tower—he was at once met by the very just reply, that naval gunnery was then unborn ; and all objections were overruled by the triumphant enumeration of Lord Exmouth's exploit at Algiers, and of Admiral Stopford at St. Jean d'Acre. There, you were told, fleets had recently succeeded in fighting fortresses, and only required to be well led to do so again. The fact that it was in both cases a mere contest between European and Eastern skill and courage, was ignored —and that at Algiers, as well as at Acre, our fleet was tamely permitted to proceed deliberately into position, and open fire at its own time and convenience, was not sufficiently borne in mind. However, our fleets had hardly sighted the fortifications of Russia, and had a taste here and there of the quality of their metal, and precision of their practice, before the fact of the extreme insecurity of the wooden ship as an engine of modern warfare, dawned on the intellect of those immediately taking part in the operations. If the Czar Nicholas would have made war according to rule, and sent his wooden ships out to fight our wooden ships, no doubt our fleet would have handled him as effectively as the Russian fleet did that of the Porte at Sinope. But that is exactly what the Russian did not do. He had no distant colonies to defend — he estimated at their proper value the man material of his fleet; and he logically argued that a crew of seamen gunners behind a shot-and-shell proof parapet upon the coast, must be a far more formidable force for our fleet to tackle, than if they were behind a wooden wall through which every projectile could pass. That he judged rightly, the history of our naval proceedings in the Baltic and Black Sea thoroughly proves. A steam-frigate of ours grounded a few miles from Odessa. She had fourteen heavy guns, throwing 32-pound shot and shell, besides two pivots of the most formidable description in the navy. She had two 24-pounder howitzers, and two field pieces (a 6-pounder and 12-pounder.) The Russians despatched from Odessa a battery of four 24-pounder or 12 pounder howitzers, with a portable furnace for heating shot. There was a fog at first; when it lifted, the frigate and battery commenced action at short range. There was no wind to affect the practice, and the only thing against the frigate was, that she could only fire a portion of her battery — yet the weight of metal was all in favour of the ship. The frigate was thoroughly searched by the enemy's fire, the shell from the howitzers of the enemy passed easily through her sides and decks, bursting and spreading destruction everywhere. The hot shot lodged in sail-bins, store-rooms, and amongst other inflammable matter. The ship was soon on fire in many places; the captain was mortally wounded—poor Giffard could do no more than die in the execution of his duty. Threatened with explosion of the magazines, the frigate surrendered, and the Tiger fell a prize to the Russians. A court-martial acquitted officers and men of all blame ; * but the

* The facts of the case speak for themselves: A heavily armed frigate, stationary

facts ought to be very instructive, and incontestibly prove that even light shells and hot shot, thrown from guns whose crews are properly sheltered, will generally master heavy artillery, where the men have only a wooden parapet. The bombardment of Odessa, for the purpose of destroying the shipping within the mole, was our next lesson. So far as numbers, weight, and efficiency of the guns upon the side of the Allies was concerned, all was in our favour. Yet prudence forbade the fleet taking up fixed positions, and deliberately engaging the open batteries and field-works of the Russians. The attacking force had to keep moving to disconcert the fire of the enemy. This measure told both ways, for our vessels, instead of hitting the fortifications alone, often missed them, and spread their shot all over an open and harmless city. We subsequently visited Odessa, and the impression left on our mind was a very painful one; for the people fancied these stray shots were intentional; and, indeed, their numbers obliged one to confess that the practice must have been very bad. We do not know whether it is so still, but all those numerous shot-marks on the houses, churches, boulevards, shops, or palaces, were then surrounded with two black circles forming a riband, on which was inscribed, "Holy Saturday, 1854," as a memento of what in Odessa was considered an attack gloriously repulsed. Of course we do not think so; for although no landing was effected, no trophies carried off, yet our object was attained; we burnt the shipping with rockets, and destroyed the Russian means of transport. Still the general result seemed still in favour of land-batteries over wooden vessels, however great the disparity of force in guns and weight of metal. We need not go into details; but amongst those engaged, there were several who readily allowed that the employment of hot shot by the Russians, to the extent that they used them, added undeniably to the dangers of ship-fights; and one vessel was often quoted as an instance of the effect of a single hot-shot well placed. She was struck by such a missile, and it rolled down near the lining of the magazine; this vessel had to cease firing, go out of action, and turn the energies of her crew to the discovery of the shot and the extinguishing of the fire. We may safely say that a naval action, upon the plan of the Odessa bombardment, will not again be repeated. It may answer, as it did at Sveaborg, to have a fleet of heavily-armed gunboats, rattling along, and firing broadcast over the area of a fortification, just to distract attention from mortar-vessels, or heavy ships that are really doing the pounding; but the issue of the combat must rest with the latter; and at Sveaborg the mortar-boats were judiciously placed at an extreme range, where the heavy guns of the enemy could not reach them with effect.

On the 17th October 1854 the final experiment of wooden ships against granite and earthen walls was made, never, we believe, again to be repeated until iron-clad ships range up in line of battle. The allied fleet was repulsed. The Agamemnon, the Albion, Sanspareil, and other ships, did all that skill, gallantry, and daring could accomplish to silence that Fort Constantine. They did not succeed; neither will the Russian official ac-

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because aground, is knocked to pieces and captured by a trumpery battery on a cliff. "I think, sir!" observed an American engineer in Russian employ, "that your Tiger's affair was caution number one. I'm cussed if I'd like to come at these chaps' hot-shot and shell in your wooden boxes!" Our Yankee friend was right to some extent; and after that affair there was more attention paid towards procuring shelter for guns' crews, especially on the upper decks of our steam vessels. Instead of letting bulwarks down, and allowing sixteen men to stand in a group to be a target for every missile, ports were more generally introduced, and bulwarks of wood again appeared. It was traditionary to use wood; "it had answered against spherical, chain, and bar shot—why not against shell and rockets?"

counts acknowledge that any damage was inflicted other than injury to the guns and parapet of the crown of that fortress where the cannon and men were exposed. To Bomarsund we need not allude, further than that it defied a huge allied fleet, but went down like a fortress built of a pack of cards when a small division of troops were directed upon it, and when our ship guns, instead of being fought behind parapets of wood, were placed on shore, and the crews properly protected.

Our huge batteries of wood, of 120 guns, and 90 guns, and 80 guns, having shown themselves unable to attack with effect such places as Sebastopol or Cronstadt; gun and mortar boats came into existence. They carried one, or at most two guns; they moved with rapidity, and were hard to hit by artillerymen accustomed to practise at fixed objects; and mortar-boats could be placed out of reach of ordinary guns. These little vessels did all the work which, at the outset of the war, it was expected would fall to the lot of our corvettes and frigates, as well as line-of-battle ships. With them the burning of the arsenal of Sveaborg, and the sweeping away of the Russians from Kertch and the Sea of Azov, were accomplished; but for a fair stand-up battering match against Russian fortresses, they were not a jot more efficacious than any other wooden vessels would be; and remember, rifled cannon were not then in the hands of our enemy.

The position was for a while very humiliating to the naval prestige of such a power as Great Britain. We still blustered, and kept on building wooden vessels, which no Ministry would have dared to direct upon Cronstadt. The French sailing fleet frankly gave up the question; they landed their guns in Kamiesh Bay, and actually constructed earthworks to defend their ships against an attack. Napoleon III. went on constructing *steam* line of-battle ships, improving upon that noble vessel the Napoleon; but we do not believe they were intended to be used against Russians, or simply as fighting ships. They played their part, and an important one too, in subsequently carrying a French host into Italy, and tearing to pieces the Treaty of 1815; but of course he did not tell us what his object was; and, with true John Bullism, we merely grasped the fact that the French were building steam line-of-battle ships, and forgot that such vessels were useless for the purpose for which *we* needed them. Louis Napoleon needed a fleet which would land a French army in Italy, Egypt, or England, as policy might require. We, mistaking his purpose, went on sinking millions up to 1859, and suddenly found ourselves in 1860 with a noble fleet fit to carry troops, but without the real engines of naval warfare which our astute ally had been all the time preparing.

General Paixhan,* who invented the mode of throwing bombs or shells from guns in a horizontal position, pointed out that plates of wrought-iron, of a certain thickness, were a sure protection against such shells; and, upon experiment, it was found that shot would not penetrate such armour. Whether it ever entered into his head, or that of any other person at that time, to apply these plates to wooden sea-going vessels, is very doubtful. In 1845 an American, named Stevens, of much repute as the designer of war steamers, carried out a series of experiments, and arrived at two important facts — that a wrought-iron plate of one inch in thickness was impenetrable to every description of shell projected from guns, and that a six-inch-thick plate was not to be penetrated by any shot, whatever its *size, range, or charge.* The reader must bear in mind that that was

* A gentleman, Mr. J. P. Drake, has for many years turned close attention to the question of applying iron plates to forts and ships, and he has, we believe, forestalled most inventions of that nature. We trust his genius and industry will now meet with its reward.

the year 1845, and that Mr. Stevens's experiments only embraced the ordnance and projectiles then known in Europe. Men talked over these facts; and they were, no doubt, duly acknowledged, recorded, tied up neatly, docketted, and placed in official pigeon-holes. That first ship bombardment of Sebastopol, and all its incidents, fell heavily on the heart of this nation; and somehow, since then, the Navy, which had hitherto stood in the front, as the best force in Britain, fell at once in public estimation to a second-rate position. Shipbuilders and old sailors played the part of children on a sea-beach, who try with tiny shovels of sand to stop the incoming tide. A cry of "More wood, boys! more wood!" was only heard in our dockyards. Ships grew longer and deeper, more unwieldy, more expansive, more showy, and more useless — because they became still more vulnerable, still more easy to be struck by shell, hot shot, and rockets, and still more difficult to handle in narrow, shoal, or stormy seas. The genius of Napoleon III., aided by the unprejudiced men with whom he had surrounded his council-table, was working out the problem in another way. He went on constructing steam line-of-battle ships of wood. They could at any rate match ours, if need called for it; and they were the cheapest and best transports he could command: they would be wanted one day. But rapidly he experimentalised, and discovered that floating fortresses, coated with Paixhan's plates, would again secure to the powers that possessed them the command of the seas, and insure the destruction of fortifications accessible to such engines of war, unless they likewise were similarly clad in armour; and even then the movable ship-battery would possess advantages over the fixed one. Satisfied with the facts arrived at in the experiments upon the iron plates of $4\frac{1}{2}$-inch thickness, the French Emperor looked next to the draught of water of his iron-clad floating batteries. The allied line-of-battle ships could never get near enough to the work. He determined that this should not be the case with these new vessels; and going, we think, from one extreme to the other, from vessels that dare not go into less than five fathoms of water, the French jumped to the conclusion that it was possible to construct sea-going vessels drawing only eight feet. The result was the launching of six formidable but very unhandy batteries. Urged by our energetic ally, we followed his example, but with apparent ill grace. We ought to have grasped at his discovery, and have improved upon it. The engineering and shipbuilding skill of this nation of sailors should at once have been directed to the creation of something worthy of her. Instead of that, tied up with prejudices, we wondered, sneered, asserted that a solid 68-pound shot of *wrought*-iron could be forced through $4\frac{1}{2}$-inch plates—forgot all the other advantages his scheme possessed, and satisfied ourselves with launching fac-similes of the French models—arks which we cannot help thinking were a disgrace to the naval architecture of Great Britain, and bore upon them the stamp of disbelief. They would neither sail nor steer, stay or wear. Yet bad as they were in this respect, they were still tremendous engines of war, and no unprejudiced sailor, who visited those batteries when they reached the Black Sea, could fail to be impressed with the fact, that we were on the eve of another vast revolution in naval warfare. Our authorities tried to get these vessels out to the Crimea in time to take part in the bombardment of Kinburn batteries, but failed, owing to the difficulty of towing such unwieldy craft. The French, having a shorter distance to accomplish from Toulon, were more fortunate, and on Oct. 17, 1855—exactly a year after the first futile bombardment of Sebastopol—three French iron-clad ships took up a position 800 yards off the strong battery of Kinburn, and fought with almost impunity to themselves, but with fatal result to that fortress. "The floating batteries of the French opened with a magnificent crash at 9.30 A.M.," says Mr. Russell, who was an eyewitness,

"and one in particular distinguished itself for the regularity, precision, and weight of its fire throughout the day. The Russians replied with alacrity, and the batteries must have been put to a severe test, for the water was splashed into pillars by shot all over them." At 10.10 A.M. our mortar-boats opened fire at a distance exceeding 2000 yards, and eventually the whole fleet came into action, and the place soon after fell. "The success of the experiment" (iron-cased batteries), says Mr. Russell on the following day, "is complete. They were anchored only 800 yards from the Russian batteries. The shot of the enemy, at that short range, *had no effect upon them;* the balls hopped back off their sides without leaving any impression, save such as a pistol-ball makes on the target in a shooting-gallery. The shot could be heard distinctly striking the sides of the battery with a sharp smack, and then could be seen flying back, splashing the water at various angles, according to the direction they took, till they dropped exhausted. On one battery the dints of sixty-three shots are visible against the plates of one side, not counting the marks of others which have glanced along the decks, or struck the edges of the bulwarks; yet all the damage that has been done to that vessel is the starting of three rivets."

Such was the French account of the damage received, and the testimony of an unprejudiced eyewitness. We know that the force opposed to those iron batteries in Fort Kinburn consisted of fifty-one guns and twelve mortars. The former were long 18 and 24-founders, and the supply of powder and projectiles was unbounded. The three iron-cased batteries, which only mounted twenty-two 50-pounders each, could only in all have had thirty-three guns actually engaged with the Russians; yet, by Mr. Russell's testimony, they fought at those odds from 9.30 A.M, to 10.10, or forty minutes—quite long enough to have sunk, or blown them up had they been vulnerable. The practice of the Russians must have been excellent, to have struck fairly, not counting grazes, sixty-three times. For instance, it may not be generally known that in the action of the Shannon and Chesapeake, an action in which the gunnery of the British frigate has often been extolled, she only put twelve round-shot through the sides of the Chesapeake, and thirty exceeds the number of "hits" of round-shot received by the captured vessel. The Shannon, moreover, could only point to fourteen shots as having been fairly delivered through her sides. We say, therefore, with Mr. Russell, that the French iron-clad batteries did receive a heavy and well-directed fire, and that there was everything to encourage us in still farther carrying out Paixhan's idea, modifying it and improving, as well as adapting it to the requirements of our navy. Instead, however, of doing so, we merely shook our heads, muttered about the 68-pounder gun being able, at musket-shot distance, to penetrate the plates, and tossed the iron-clad batteries aside, just as we did Lancaster's rifled cannon, without taking the trouble to follow up the subject, or remedy discovered deficiencies.

The peace came in 1856; England was satisfied to go back into her old groove of tradition. The gunboats, as if no improvement could even take place in them, were drawn up with a view of being preserved for ever—the Lancaster guns and rifled ordnance were pitched aside, and the question of mail-clad ships was not even entertained. Yet there were naval officers who urged the adoption of some imitation in iron of the granite casemates, with which military engineers were hastening to cover the artillery of our sea defences. The French, on the other hand, went on experimentalising and adopting, with modifications, both the rifled cannon and the iron-clad ship, and even despatched gunboats armed with *canon-rayée* to China in 1856, when neither in our naval nor military arsenals such a weapon did exist. Silently, but swiftly, Louis Napoleon arrived at certain conclusions, adopted rifled cannon for his field batteries, and, whilst we were still incredulous, took the field against Austria, and swept away her hosts with that

terrible artillery. More than that, he had constructed *iron-clad gun-boats,* and held his iron-clad batteries ready to bombard Venice or Trieste, if the issue of the war had remained long doubtful.

Great Britain awoke at last to the danger of her position. Who knew the day but that she, like Austria, might find her policy at variance with Bonapartist interests? Were we, too, to be rolled up in a three months' campaign? A general movement took place, and the energy and intelligence of the nation soon forced us, assisted by the engineering resources of England and Scotland, into a safe position upon the important point of rifled cannon. But how about the ships? And here came the old prejudice again. Oh! we only want *steam* line-of-battle ships, so much longer, so much deeper, so much faster, and, they might have added, so much more unwieldy than our sailing fleet of the same class. "The French have fifty line-of-battle ships —we must have as many," urged the public. The money was granted by Parliament; they were soon in the water. "The French have more steam-frigates than we have—we must have as many," again urged our wiseacres. The money was granted, and they likewise were soon seeking for water deep enough and seas wide enough to cruise in—and yet, what use are either of these to us to-day? We don't want the former for transports, and of the latter we may say with the Gosport waterman, "They are precious handsome, sir, but useless for doing frigate's work."

Whilst our yards resounded with the labour of shipwrights upon wooden line-of-battle ships and frigates, the French building-slips were vacant. The attention of the Emperor and his admirals was engrossed with the question of how to place the armour tested at Kinburn upon perfectly handy, seaworthy ships. Aided by a M. Dupuis de Lome, who had studied shipbuilding in England and Scotland, the subject was soon reduced to practical shape. The result of their investigations and experiments may be briefly stated. It was decided that the lofty sides and vast area of line-of-battle ships was an error in these days of good gunnery: that a three-decker of wood offered an area of ten thousand square feet of inflammable and penetrable matter; whilst a frigate iron-clad would be invulnerable to all shells, hot shot, and nine-tenths of the solid shot in existence, whilst only offering an area of about four thousand square feet: that the smoke of the guns in such single batteries would clear off sooner than in vessels of two or three decks: and that there were a multitude of advantages in the long low vessel, over the lofty castles called three-deckers. To carry a heavy battery as well as their coat of mail, the displacement of these vessels was required to be equal to that of wooden two-deckers; in fact, an iron frigate must be as big as our Agamemnon. The next thing done, was to commence upon the construction of ten frigates, which, if the calculation of those who believe in them be correct, are equal in force and fighting qualities to about thirty sail of the line. Had the capabilities of the French dockyards been equal to the genius and energy of the Emperor, the sudden apparition of such a force in the English Channel might well have occasioned a sensation at the Royal Exchange. There were, however, many questions that could only be solved by practical experiments on board such ships; whilst, therefore, the shells or hulls of all the ten were progressing steadily, one frigate, the Gloire, was hastened as an experimental vessel. Speaking of her, Mr. Scott Russell says, that, "in justice to M. Dupuis de Lome, the Gloire, although a great success, must not be considered her builder's *chef d'œuvre.* She was built to meet the peculiarities of the circumstances in which a builder in France at that date inevitably found himself placed. Had he lived in an iron country like England he would probably have adopted an entirely different construction, but, like a wise man, he made the best of the materials he had at hand, and has been rewarded with corresponding suc-

cess. I say this much because I have heard the question mooted of our proceeding to make imitations of the Gloire."

From this statement, together with what we hear in other quarters, it is to be inferred that the French architect advocated vessels built entirely of iron, but that the want of that metal, together with the comparative cheapness and abundance of wood, compelled the French to adopt wooden shells covered with plates of iron. There are many reasons why the structure of these armour-clad ships should be entirely of iron, when circumstances will admit it. The more rigid and unyielding the basis upon which the armour-plates rest, the more impenetrable the plate. A four-inch plate covering a solid block of granite is said to be perfectly impenetrable. Then we know that a vessel or shell of iron of a thousand tons may be made to be lighter and stronger than one of wood. Safety may be better insured by iron-plate compartments in the interior, as well as a cellular skin, or ship-within-ship mode of construction; and lastly, iron vessels alone, it is found, can be sufficiently well fastened about their stern frames to stand the shaking of the screw propeller at a high speed without leaking very seriously.

The Gloire, as we all know, was launched, and went on her maiden cruise this summer in the Mediterranean. Those on board returned perfectly satisfied with her performances, and reported most highly of her. They said she more than realised every just expectation. The French press sounded any number of trumpets; we still doubted. "Oh! only let her be caught in a gale of wind," growled out our old sailors, "you will never hear any more of her, or of iron-plated frigates." Well, she was caught in a gale of wind while escorting the Emperor to Algiers. There was no flourish this time; the fact was, the French found we were beginning to be inquisitive. "Ah! told you so," chuckled the ancients; "utter failure, depend upon it — Frenchmen ashamed of their Gloire; heart of oak is your real armour for British men-of-war, sir!" One morning the *Times'* correspondent from Paris wrote as follows, and there was sudden sorrow amongst the prophets :*—"At a cabinet council held a few days since, at which the Emperor presided, it was resolved that a number of steel-cased frigates should be constructed, on the model of the Gloire; Admiral Hamelin, Minister of Marine, Vice-Admiral Bonet-Willaumez, and Rear-Admiral Dupony, spoke in favor of the measure." This was pretty conclusive, and set at rest, in the opinion of most of our younger officers, the question of the general sea-worthiness of these ships in armour. They might not be perfect, but the probabilities were, that in qualities as sea-boats they were quite equal to the new steam-frigates and line-of-battle ships. They could hardly strain more in heavy weather; they might leak a great deal less, and their expenses for wear and tear in a cruise could not possibly be greater; and so far as fighting qualities went, it was a question capable of almost mathematical demonstration, that the odds at gun for gun were ten to one in favour of the Gloire.

We have thus brought the history of the French armour-clad ships up to the present day. Let us turn to our own land, the land of Athelstane the Unready, and see what we have been about. The state or strategical reasons—motives for the mystery in which many of the experiments have been wrapped—we will not presume to question; but if it, in some respects, renders our history imperfect, the fault will rest with others; enough has been, however, made known, to enable us to arrive at conclusions as likely to be correct as the majority of deductions drawn from published data.

The conclusion of the Russian war left the Admiralties and War Offices of Paris and London in a most op-

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* See *Times'* Paris Correspondence, October 15, 1860.

posite condition of mind as to the naval requirements of the two countries. Like those two eminent lawyers who accepted the same premises, used the same arguments, yet arrived at exactly opposite conclusions, the heads of the executive departments of the two countries differed entirely as to the utility or advantages of these iron-clad batteries which had been first tried in 1855. We remember, indeed one of our best and most valuable admirals—one whose recent experience under fire added to the weight of his opinion—pointing to those French batteries, and assuring us that, in England, they could drive shot through and through them—at least he was told so. Yet he allowed something must be done to stop shell, hot shot, and rockets; and he cordially took up the invention of Captain Cowper Coles for shielding guns' crews with iron cupolas, and urged its adoption upon the attention of the Admiralty. Captain Coles had, in effect, adopted the shield of 4½-inch iron, but with certain modifications and many decided improvements. That Lord Lyons and Captain Coles were not singular in the opinions they held, the annexed official report will show.*

We point to this raft of Captain Coles, because it shows that the necessity for an iron shield to protect guns' crews had taken a firm hold of the minds of the naval officers immediately engaged in the operations before Sebastopol. Another officer recommended an adoption of this armour to our gunboats for the protection of the very exposed crews and engines. Sir Edmund, afterwards Lord Lyons, it will be seen, concurred in the necessity of both these measures; but the advice or opinion came from young officers, and, with the peace of 1856, these projects appear to have been dismissed as utterly unnecessary. The perseverance of the French Admiralty, War Office, and, above all, that troublesome Emperor—who not only keeps all his own people up to the mark, but makes us likewise continually wipe our spectacles—did not leave our builders of wooden ships quite at their ease. Rumours would ooze out of certain designs and projects, based upon very satisfactory experiments, by which our Gallic friends expected to render the ship in armour as fleet and as seaworthy, and fivefold more powerful, than the ship without armour.

We pooh-poohed the idea, and said it was one of the freaks of genius—good in theory, bad in practice. Yet, somehow there was not the

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* "H.M.S. Stromboli, Kasatch, in the Black Sea.
13th November 1855.

"Pursuant to an order from Rear-Admiral Sir E. Lyons, Kt., G.C.B., Commander-in-Chief, &c. &c. &c., we, whose names are hereunto subscribed, have repaired on board H.M.S. Stromboli to inspect a gun-raft proposed by Commander C. P. Coles, R.N., and we are of opinion that the invention is one of the greatest practical value.

"It appears, by the model which Commander Coles produced, that the raft combines many advantages, amongst which are—1st, Light draught of water; 2d, Facility of propulsion; 3d, Simplicity and rapidity of construction; 4th, Great buoyancy—one heavy gun or mortar can be used on each with great precision of fire; 5th, Protection of the crew.

"Looking to the probable nature of future operations against our present enemy, we are further of opinion that this proposal merits the immediate attention of H.M. Government; and in order that the full benefit may be derived from it, we venture to think it desirable that Commander Coles should be directed to proceed to England and personally to explain his proposal to their Lordships.

"We further suggest that under the present circumstances, *secrecy* is desirable.

"*President*—Rear-Admiral Sir Houston Stewart, K.C.B.,
Second in Command.
Capt. Arthur Cumming, R.N.
Capt. E. A. Inglefield, R.N.
Mr. Rumble, Chief Engineer of H.M.S. Royal Albert.
Carpenter of H.M.S. Hannibal.
Captain H. Hay, H.M.S. Hannibal."

perfect ease which people enjoy who feel they are thoroughly in the right. "Early in 1857," says Capt. Halsted, "preparations were made with a view of testing the sides of the Trusty at 450 yards." It is evident some one had misgivings. Nothing came of it, and a year passed without certain progress in one direction or the other. We suppose that some gallant artilleryman had again driven a hole through a $4\frac{1}{2}$-inch plate with a solid 68-pounder shot at 200 yards. There was feverishness, however, in spite of the pretended calm, and we are told in the *Quarterly Review*, by a writer who appears to be sure of his authority, that "as early as 1856 designs for an iron-plated corvette with fine lines, and destined for high speed, very similar to those now being constructed (in 1860), were submitted to the Admiralty." *

The clouds that were gathering over Italy towards the close of 1858 drew fresh attention to our defences, naval and military, and the question of the penetrability of iron plates again came up; but before we proceed to consider the fresh experiments, we must remind the reader that one fact had evidently been arrived at by all authorities, that shells, filled either with explosive or inflammable matter, were the projectiles with which speedily to bring wooden-ship actions to an issue; and that all batteries placed near the sea ought to be furnished with furnaces for heating shot. The inflammability of men-of-war, and the accessibility of their weak points—the engine-room and powder-magazine—were thus acknowledged. Seamen-gunners swore by shell-guns, and the 10-inch gun became quite a pet; its shell carried 5 lb. of powder; its explosion would silence for some time, we were told, any deck of guns on which it lighted. We armed the great frigates, built in imitation of the United States' Niagara and others, with this wonder-working gun; whilst our cousins across the Atlantic armed such line-of-battle ships in disguise with shell-firing guns alone. Some of their vessels had actually no solid shot whatever on board, and we were fast following the example. We beg the reader to keep this in mind, for no one now denies that shells are useless against iron-clad ships. We will now relate how the Trusty and iron plates were next maltreated, in what, with all due deference to Woolwich and the Excellent, we consider a series of tests very unlike what a ship in armour would be subjected to in a naval action.

In January '59 the first experiment was made with an Armstrong gun, a 32-pounder, that had a range of 9200 yards, or $5\frac{1}{4}$ miles. Fourteen shots were fired with 6-lb. charges of powder at distances the maximum of which was 450 yards, and gradually closed towards the Trusty's sides, until there was an interval of only twenty yards! The shot used were cast-iron, wrought-iron, and steel ones. Only two of the steel balls succeeded in fixing themselves into the joints between the plates; and, says Captain Halsted, the Armstrong 32-pounder "*was powerless to injure seriously the complete protection of the ship's side.*" We own we were astonished at this statement, but don't wish to take advantage of it to any serious extent in support of our opinions, because we consider the attempt to drive in iron-plates, bolted on to wood, with Armstrong guns, even with his 3-pounders, at twenty yards, must in time have proved successful; but nothing could have been more unlikely than that an iron-coated ship should be subjected to any such treatment upon the high seas, except from another iron-coated opponent. A wooden vessel approaching the Trusty to try such an experiment would, in the language of sailors, have been sent "to glory"! —and if it was Fort Constantine that the Trusty was engaging, her captain must be an idiot to close it to such a distance as twenty yards, when the recent experiments on the Sussex martello tower with Armstrong's guns, as well as the

* See *Quarterly Review*, Oct. 1860.

breaching of Bomarsund, would tell him that stone and brick might be effectually treated at much greater distances. About the same time, it appears that some experiments were tried at Portsmouth upon the Alfred frigate, coated with 4½-inch plates. In addition to the old fact that the ordinary spherical 68-pounder shot of wrought-iron would pass through such a ship at 450 yards,* it was discovered that a Whitworth bolt of the same weight would do as much at the same distance. Now, unless Mr. Whitworth can do more than this, we are not prepared to allow that he has done much. A sphere of iron weighing 68 lb. has a diameter of 8 inches, and consequently makes a hole through timber of that dimensions. Mr. Whitworth rolls out the sphere into a long bolt, diminishing its diameter very considerably, thereby reducing the resistance to its entry. The consequence is, that his bolt makes a small hole, and the sphere a large one. This is a very important point in ship actions, so far as damage to either an iron-clad or purely wooden ship is concerned, and may be more easily understood by the inexperienced, when we assure them that we have seen timbers, planking, and spars, through which balls of three inches diameter have passed in action, and that the hole left was so small as to be almost difficult to detect, from the natural elasticity of the woody fibres filling up the aperture. We do not, however, purpose to write a treatise on the laws, nature or action of projectiles, but to deal with them in a general sense. We say, therefore, that those first experiments upon the Alfred showed but slight advantage in Whitworth's weapon or projectile over the solid 68-pounder, as an annihilator of iron plates. Another series of experiments with the same Whitworth's bolts was subsequently made on the Trusty, one of the original batteries. The distance selected was 200 yards! There was, we are told, a breeze and a small sea on, as if either would be unnatural in a sea-action. Five shots in all were fired; and mark, only two fairly entered the ship through her side; two others struck obliquely, and struck in the broadside; and one shot missed the Trusty. Thus only two out of five of these shots took full effect; and had the Trusty been playing her part, the probabilities are that a much smaller proportion would have gone to the good of Mr. Whitworth's bolts. Let it not be forgotten either, that no gunboat or wooden ship in existence would be able to take up with impunity such a position, with respect to the Trusty, as his gun, or the ordinary 68-pounder, was placed in. So far as the ordinary sea-service 68-pounder gun is concerned, the question is a very simple one. Grant that, when brought up fairly abreast of, and at right angles to, a 4½-inch plate, placed over and bolted to *wood*, it penetrates the plate at a distance of 200 yards. The ball, however, must be an especial one, made of wrought-iron: not, as all cannon-balls are, of cast-iron. The expense of this becomes at once a serious objection, coupled with doubtful advantages. The cannon itself is the most rare and most unwieldy piece of ordnance we have in the navy; it weighs with its carriage more than five tons, and may not be cast loose for action in anything approaching to a heavy seaway. Our present frigates and ships of the line can only carry a few of them. The gunboats which are fitted for them only embark their 68-pounders in smooth water; and as a general sea-service ordnance, it is anything but desirable. Amongst many objections we will enumerate the following:—Its great weight calls for a crew of sixteen powerful men; its training and elevation are necessarily slow; the ports required are so big, that, in these days of rifles, the gun's crew would be swept away by sharpshooters; the increased weight of the shot, 68-pounders against the ordinary 32-pounders for sea-service ordnance, will necessitate more capacity in shot-lockers and magazines—*ergo*, larger ships. One 56-cwt. 32-pounder, with its hundred rounds of shot and

* Captain Halsted denies that this was the case in the experiments he witnessed.

charges, would weigh about twelve tons; but one 68-pounder, with the same quantity of shot and powder, would weigh at the least twenty-three tons, or very nearly double. In short, our Royal Albert ought to be of twice the size to carry these 68-pounders, and they can alone at 200 yards pierce the armour of the Gloire, provided the Gloire kindly lets them come near enough before sinking, firing, or blowing up such monstrous targets. So much for our solid shot 68 pounders.

"Ah! but," Mr. Whitworth may reply, "my 68-pounder throws a solid shot, and is still a light gun." Granted. But don't forget that, instead of making a 9-inch hole, the Whitworth only makes a 3-inch one; and that, at that rate, the Whitworth will have to be a 2-cwt. bolt, to make as big a rent in the plate as our old friend just dismissed. When Mr. Whitworth makes such a gun, and it is approved as safe and serviceable, we will be ready to discuss its merits, weights, &c. But there is another point, which neither he nor other armour-piercing gun-inventors should forget, that it is not *solid bolts* which naval officers fear, any more than solid shot. We could astonish him with an enumeration of the extraordinary quantities of solid shot which have, in very recent times, been poured into a vessel in action. The French flag-ship in the battle of Obdigado had a hundred-and-odd shot through her sides—H.M.S. Dolphin, a schooner, nearly as many; yet they won the victory.

Under all circumstances, therefore, it is not astonishing that in 1859, whilst the Conservative Ministry were in office, our Government took heart to order four iron-clad vessels to be constructed. The Admiralty called upon constructors of iron and wooden ships to send in plans and tenders; and we are told that the result was a perfect avalanche of inventive genius, which was most bewildering. It proved, however, how great were the resources of this country in producing these armour-clad ships or steam-rams.

An order for two large vessels and two smaller ones was eventually given; but before describing them, let us strive to meet the many objections to such an alarming innovation in men-of-war; and the objections did not all emanate from old sailors and shipwrights, for even to the present hour we have men of undoubted genius—such men as Mr. Whitworth, for instance—giving their support to the obstructionists. He naturally believes in his own particular leather or projectile, and quite forgets that, although his gun might be a very Shitan to these new mail-clad dragons of the deep, it will be far more dangerous to wooden ones. Indeed, if half we hear be true of these new rifled shells, our present Dukes and Royal Alberts, full of sailors, will be like baskets full of chickens hung up to be fired at with impunity—or one of those Druidical sacrifices, represented in our pictorial history of England, in which ancient Britons were piled up one on the other, and then set fire to. Touched, no doubt, with some such horror, and confounding the Gloire with our wooden slaughter-houses, Mr. Whitworth is troubled with a vision of a large heavy-plated ship, attacked by smaller and far swifter vessels of wood, carrying powerful guns, and choosing their own distance for striking the ship which presents so large a target. "What would be the result," says he in a letter to the *Times*, "of firing flat-fronted shots at her plates below the water-line, or of their concentrated fire directed upon the axis of her screw?"

We will tell him, provided that he will allow the Gloire to have as good guns as his wooden Musquitoes. In the first place, by his own showing, the distance the wooden vessels would have to choose, would simply be the arbitrary one at which it is known their solid shot would penetrate the mail-clad sides of the Trusty. There would, in short, be no choice about it; they would fire their projectiles in vain, or have an especial range which those on board the Trusty will know as well as those on board the Musquitoes. And as Mr. Whitworth's gun has a range of some three or

four miles, the Gloire would be hitting the Musquitoes from the time they came within 5000 yards, whilst the Musquitoes might as well fire at the moon as at the Gloire until they are 450 yards off, at which range a seaman gunner will hit a gunboat moving at any pace. The crew of the Musquitoes, if they still exist, come then within easy range of every missile, from the revolvers up to the diaphragm shell of the Gloire, whilst her people can only be injured by the passage of *solid* bolts of cold iron into the ship. Whose position would be most enviable then? And supposing every man in the Musquitoes to have ten lives, and to be as brave as Julius Cæsar, we still think it would go hard with them.

"Ah! but I fire one flat-fronted shot at her below water, and down she goes," says Mr. Whitworth. No such thing, dear sir; we will meet that fallacy presently; and did those who believe in practice below water, ever see a flat-headed bolt making ricochet practice? "A chance shot," as the American one-gun privateer observed to the captain of a 50-gun frigate, "may knock the devil's horns off;" and a chance Whitworth may have passed through 30 feet of water, and penetrated a wooden bottom; but to make direct practice, his gun must be within 20 feet of his opponent. And we should like to see Mr. Whitworth trying his experiment in action at that distance in the present day; or rather, for his own sake, we hope he never may, except in an iron-clad ship, or one of Captain Cowper Coles' iron cupolas. As to concentrated broadsides in a sea-way, we say with the sapient Mr. Glasse —first catch your hare. Lastly, Mr. Whitworth must not, in speaking of his projectiles and their effect upon iron-clad ships, forget to keep in mind that, if dangerous to them, such projectiles must be far more destructive to wooden line-of-battle ships. It is this comparison which must constantly be kept in view by those who wish to arrive at any safe conclusion upon the subject.

There is a tale of the past war with France, which bears much upon the present question: Does security for the men at their guns add to the chances of victory on board of a ship; —and, though a digression, we may be pardoned for repeating it. In the year 1796, a frigate called the Glatton was cruising in the North Sea. She had been originally an Indiaman, and, with others, had been bought into the navy in consequence of the lack of ships. She was of such remarkably stout scantling, that to be as strong and slow as the Glatton, was, we have heard, a proverb in those days. She naturally was able to carry heavier metal than vessels of her class. One July night, stout Henry Trollope, her captain, sighted off the coast of Flanders four large French frigates, and they were afterwards joined by two corvettes, a brig and a cutter. Many men would have avoided such odds—the Glatton's captain did not. The enemy formed in line; old Stout-sides stood steadily on, and, by the first watch of the following night, tackled them. Tradition has it that the fast sailing-ships of the enemy were prancing with delight. We can easily conceive it. "Vill you ishstrike," shouted out the Frenchman to the challenge of the Glatton. "Yes," was the quiet remark of the gallant Trollope, "and d—d hard too!" and he tumbled his old tub amongst them, taking their fire with comparative impunity, and knocking them about with his guns in a manner which astonished them. Figure to yourself, reader—because you need not be a sailor to understand it—one ship of 56 guns, with strong sides, enveloped in the fire of four frigates, of 50, 38, 36, and 28 guns, two 22-gun corvettes, a brig and sloop, driving them before into port, and yet having herself none killed and only two wounded. Amongst other curious incidents of this noble action, which appear to bear upon the argument we seek to deduce, the 26-gun brig and 8-gun cutter actually for a while took up a position under the Glatton's stern, where only musketry could be brought to bear upon them; yet they did not, it appears, turn the tide of battle. As the French fled, and their losses were never known, we cannot report of the damage they

experienced off Flushing, but we can easily understand how much they must have desired that the Glatton's sides could have been easier pierced by their 24 and 12-pounders. James, the naval historian, we are aware, attaches much importance to the Glatton mounting 68-pound carronades. Her armament may account for the damage to the enemy, but not for the trivial casualties among the noble Trollope's crew; that must go to the credit of stout oak or teak against the cannon of those days. With respect to sinking armour-clad ships by means of firing shot at them below water-line, we say that these vessels may be so constructed as to receive more shot below water with impunity than any wooden craft in existence. A cellular skin, upon the Great Eastern principle, together with a number of perfect internal compartments, and steam pumps capable of delivering a large volume of water, will make the sinking of such ships as the Warrior a very difficult feat indeed. No wonder, we say, if the Admiralty and Horse Guards were harassed with such fears and objections, that they have hesitated to go heartily into the new system.

Happily all inventors of rifled guns have not agreed with Mr. Whitworth. Sir Richard Armstrong tells General Peel, late Secretary of War, "that if we can produce iron-cased vessels, attaining anything like the same speed, and as sea-worthy as ordinary men-of-war, no other vessels will have the slightest chance against them." This is strong testimony. Sir Richard has been passing his shells through the stoutest wood-butts with ease; he has breached martello towers, and shaken granite walls; but he knows that, except when placed over a yielding substance, no shell or shot that he has invented — not even his 100-lb. solid shot—can penetrate slabs of wrought-iron; and it appears to be immaterial whether the projectile have a flat head, sharp point, or punch point! The last experiments against iron-walled embrasures at Shoeburyness are conclusive on that subject; and, convinced of it, he frankly yields that, after all, the French are right. All honour to him. He deserves well of the navy for having said so; for we believe, had he still been sceptical, we should have still gone on thumping away at these plates for years to come. Expense was the next bogie; it still stands its ground. We are told on unexceptional authority, that the two large mail-clad frigates now building, the one in the Thames, and the other in the Clyde, will cost the pretty figure of a million sterling! A very dear million's worth, in our opinion; but we are always expensive in Britain when we desire to be energetic. We shall build iron-clad vessels for much less than that some day; but if ever we should not be able to do so, an officer, who for years has had his attention directed to the subject, assures us that one gun covered by a shield of iron on board a ship, is equal to ten guns mounted in an ordinary three-decked line-of-battle ship of wood; and as the broadside of our Royal Albert counts sixty guns, the iron-clad vessel of six guns of a side would be her match. The Warrior or Defiance, therefore, with their 36 guns, are each equal to three of our largest three-deckers as engines of war. Why, then, be so startled because they cost as much? Captain Coles estimates the value of the largest frigate (iron-cased) of 36 guns at £320,000. The value of three Royal Alberts or Dukes of Wellington would be about £600,000; and as an investment for public security the former would be the better property, although not quite so ornamental. The relative fighting powers of guns and crews properly sheltered, from those placed in ships previous to every missile, is very remarkable; but no one can form a better estimate upon the subject than the gallant officer above quoted, for his experience extends through every action in which our wooden fleet was engaged in the Black Sea, and we entirely adopt his opinions. After the expense of these vessels, the next question has been their sea-worthiness and speed, combined with their capability of carrying guns well above water.

So far as sea-worthiness goes, the question can never have been dispassionately considered, or there would not have been a doubt upon the subject. To bring it home to the minds of the general reader: Let us suppose that the Duke of Wellington of 120 guns, and with nominally three, but actually four fighting decks, be taken into a basin —that we cut off from that towering structure all the wood, decks, and sides above her lower gun battery, leaving her say sixteen guns of a side; and that we throw into a huge scale and have weighed, all that oak, teak, bolts, treenails, plank, and beams; add to that the 88 guns and carriages, with a hundred rounds of shot and powder for each of those 88 guns, as well as other fighting gear; then let the 800 seamen belonging to those decks be requested to get into the scale with their clothing and three months' provisions, as well as six weeks' water, and an aggregate of weight removed out of that three-decked ship would appear on the index of the steelyard which would astonish most people. For instance, we have calculated roughly, and at the lowest figure, what the fighting gear alone upon those three removed decks would be, and the result is no less than 1100 odd tons weight.* Now, we maintain that, if on the remaining portion of that ship's side, iron be spread equal in weight to that removed, there cannot possibly be any sound reason why such a cut-down three-decker should not be a better ship than when all those weights were piled upon top one of the other to a height of fifty feet? Will not the same steam-power move the same weight faster when the hull offers smaller resistance to winds and beating seas, and when the masts and spars are proportionately reduced? Will her weights be worse, or more trying to her sides in a tempest, because they are lower and nearer the element that supports them? Assuredly not. And, if we take care that on the displacement, or bottom, so to speak, of the razéed "Royal Albert," we take care to place a less weight of armour than it had to carry in timber and metal when she was a three-decker, will not her lower tier of guns be higher out of water? Of course they will. Then all we have to do is to keep this in mind —to take care that the displacement of these new Warriors is equal to the weight to be carried; and they will then be fleeter, safer, stouter ships at sea, and as good a protection to Old England for years to come, as our wooden walls were in years gone by. We should only tire our readers by dwelling longer on the point of sea-worthiness, which, after all, is attested by the Gloire, and we hope will very soon be by our Warrior and Defiance. Speed is the next hobby-horse of the opposition. They will be of no use unless they are faster than wooden ships, they argue. Why so? If they are as fast, surely they will be as good; and there is more nonsense talked of the speed of our great frigates and liners of wood, than unprofessional men are perhaps aware. The measured mile at Stokes' Bay, upon which depends the question of the constructor and contractor, the school of naval architecture and the engineers, fulfilling all expectation of a confiding Admiralty and a generous country, is one thing; a knot by the ship's log three months afterwards against a moderate breeze and head sea in the Atlantic, is, as the Spaniards even know, quite an "*otra cosa.*" When the reader takes up the *Times*, and finds that H.M.S. Screamer, of 90 guns, went in Stokes' Bay 13.8 knots, equal to so many more miles, and only required the length of Plymouth Breakwater to turn in, he must not run away with the idea

* Taking each gun—its gear, shot, shell powder, &c.—as 12 tons, it gives 88 × 12 = 1056 tons, × 50 tons for arms and ammunition of the 800 seamen and marines. This estimate will be a low one, because there are a multitude of small stores supplied for the service of a man-of-war's armament, all of which would be wonderfully reduced in cutting a three-decker down to a single-decked ship.

that it will often be so. Ten knots will probably be her natural speed,—a very good speed, too,—and against a double-reefed breeze and head sea, proud must be the naval centurion whose bark will go steadily half that number of miles per hour; and in either case we should be very sorry to pay the bill for caulking seams, docking for leaks, or repairing defects of the Screamer. We dare not tell all the stories we know on that head; but great speed in great ships is a popular error, except when the wind is fair, or water nice and smooth. But allow that ten knots can often, under favorable circumstances, be steadily maintained in wooden vessels, is there any reason why as much should not be done by our mail-clad ones? For our part, we think handiness and light draught of water far more important points, and urge that they should not be sacrificed to speed. Actions are never fought at high steaming speed. There are fifty reasons against doing so. Chasing is all very well; but a long pair of legs will only insure occasional safety, not victory, against the Gloire. Our long-range guns place a wooden enemy under fire at three or four miles distance; he would have to come as near as that to know what the slow ship was made of. Honour would forbid that the wooden Screamer of 90 guns should leave the 36-gun Turtle without trying a throw, and then God help the Screamer! On the one side, immunity from every projectile but solid shot, delivered at a half-musket range; on the other 900 gallant men, working over magazines of powder and shell, furnaces and boilers, contained within a hull of wood—a huge target of living creatures and explosive inflammable matter, through which every hellish invention of shell, hot shot and rockets, can run riot. Heaven help brave men thus sacrificed. Oh! but you have your weak points, too, insist the believers in wood. You fight in a casemate; but then your ports must be open, and through them, by aid of my rifled guns, I throw shells filled with inflammable matter, and hoist you in your own petard. We demur to this statement on two grounds. In the first place, we can fight without even opening a port-hole; and, in the next, a correctly-constructed war-ship should have no wood whatever employed in her hull or lower masts—nothing to ignite except her stores. The mode in which men-of-war can be constructed to fight their guns, and elevate or train them without exposing an aperture to the enemy's fire of more than 3½ inch diameter, involves a long mechanical explanation, ill adapted to the tastes of our general readers. We must, therefore, ask them to accept our statement for the present that the difficulty has been met by Captain Coles, and that we believe a modification of his cupola may be even applied to the ports of such ships as the Warrior, and keep out, at any rate, shells, rockets, or hot shot. These cupola, or shield-ships, will be hereafter described; models of them may be seen at the Royal United Service Institution; and the difficulty of fighting a gun without opening a huge port has been solved.

Let us pass to the consideration of the two next objections, which are brought forward with a view to frighten us. It is disheartening, says one statesman, to think that, after all the exertions and lavish expenditure of the two last years, there is reason to fear that it is time, material, and money thrown away. We have just got fifty screw line-of-battle ships, are they to be burnt? or, like our sailing three-decker and screw block-ships, to be consigned to the limbo of the mistakes of this century?

We think all this alarm—all these fears—uncalled for. Keep all the wooden vessels of war that we now have, but build no more, until the new experiment in iron has had a fair trial. If, as we firmly believe, the Gloire and Warrior class prove to be steps in the right direction, all we shall have to do will be to cut down the big three-deckers, in the manner we have already described, and put the wooden frigates into armour. Iron plates over wooden shells will not be as strong and perfect as

iron plates over iron shells or hulls; but inasmuch as our great naval rival France is, from necessity, obliged to adopt the former mode of carrying armour, let us, for convenience and economy's sake, do likewise. Our new 50-gun frigates may be converted into 8-gun corvettes; our corvettes into mail-clad gun vessels. Ships that cannot carry 4½-inch plates had better carry 3-inch ones, rather than none at all; for it is known that a plate of *one inch* in thickness is impenetrable to every description of ordinary shell and hot shot. Let us go to work with a will upon the subject, earnestly, not recklessly. France is building no more wooden line-of-battle ships, but next spring she is to have ten Gloires in the water, it is said. Why should we not on the 1st May have as many wooden ships in armour? We can, at any rate, with these hold our own, whilst the entirely iron vessels are preparing at a steadier and surer pace.

To the royal navy, and the sailors, as well as merchants of England, the problem to be worked out by these iron-clad ships is one of the deepest interest—the deepest moment. The Report of the Royal Commission on the Defences of Great Britain tacitly admitted that, in our wooden walls, England could no longer rely for security against insult and invasion. We who, in times gone by, with ships of oak, swept our enemies from the seas, can with ships of iron do as much for the future. We have the iron, the coal, and the skill in this country to preserve to us our proud supremacy, and to enable us to repeat at Cherbourg or Cronstadt the deeds of Copenhagen and the Nile. In the words of the Prussian Marshal, "Forward!"