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Captain C. C. P. Fitzgerald R.N.

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HOW CAN WE MAKE THE MOST OF OUR SHIPS?¹

By Captain C. C. P. FITZGERALD, R.N.

As an ironclad takes so many years, from the day that her design is finally decided upon until the day that she is put into commission, and becomes of any value to the State; and as I presume that the most far-seeing statesman in this or any other country would scarcely be bold enough to commit himself to any positive assertion as to how many years, or even months, will elapse before the peace of Europe will be broken, and England, even against her will, be dragged into a war, the questions which present themselves most forcibly to thoughtful minds are somewhat as follows. Is our Navy ready for war? If not, is it in such a state that it could be got ready during the time that we might reasonably expect would elapse between the first serious threatenings and the actual declaration of war, bearing in mind the extreme rapidity with which all recent wars have threatened, gathered, and burst, out of an apparently clear sky?

I will not touch upon the political side of the question, by asking whether the sky looks clear now, or not; that is a question which must be left to statesmen and diplomatists to ask and answer. I only propose to submit such questions as may be fairly discussed by naval Officers; but I scarcely think that our rulers and administrators have realized the fact that a ship building or incomplete, either as to her guns, or any other particular, is of no value to the country; that undeveloped resources are exactly on a par with good intentions; and we all know how much those are worth.

The question of how much money is to be spent on the Navy is a question for the taxpayers, and for the representatives whom they return to Parliament; but the question of whether we make the most of what we get is one which may fairly be discussed by naval Officers; and as opinions differ so much as to the utility of the different modes of offence and defence, the more it is discussed the better.

Many thoughtful and well-informed naval Officers, and also some statesmen and independent Members of Parliament, have lately expressed their views freely in this theatre, as to the inadequacy of our naval forces to protect the vital interests of the Empire; these opinions, deliberately formed, and moderately though unambiguously expressed, appear to have received but little attention at the hands of our self-governed, and, I am afraid I must add, self-satisfied and short-sighted fellow countrymen, who still seem to think that they know more about the subject than we do, and continue to be prac-

¹ The paper was written in May last with a view to being read and discussed, but was temporarily withdrawn by the author in consequence of the apprehended war with Russia.—ED.

tically deaf to all our warnings. In most of the affairs of life sensible people take the opinion and follow the advice of experts, who have made certain subjects the study of their lives. If we employ a doctor, we follow his advice as to the means which shall be taken for our cure. If we employ a lawyer to defend us, we follow his advice as to the means which shall be taken for our defence. But with the Navy it is not so; civilians decide the means which shall be taken for the defence of the Empire. Civilians propose the estimates, usually for party and not for national requirements, and they also decide how much of the money voted shall be spent upon each of the branches of a very complicated and technical profession. Civilians build our ships, and occasionally astonish us with some very original, but curious designs, based (as a distinguished Officer has described them) upon untried hypotheses.

The policy of putting the administration of such a technical profession as the Navy into the hands of civilians would appear at first sight to be somewhat strange and unreasonable; but the nation wishes it to be so, and whatever the nation wishes is law, and must be right; and I am not so vain as to suppose that anything I can say will alter it; nothing but a national disaster will do that; and then it is just possible that it may be a little too late to alter anything. England has been a little too late once or twice lately; it appears to have become the national watchword, and I hope the country is proud of it! "Ready, aye ready" has hitherto been the motto which the Navy has endeavoured to act up to, and which I most sincerely hope they will still endeavour to act up to, no matter what discouragement they may receive from their countrymen, by having a deaf ear turned to their warning and advice; no matter how inadequate the means at their disposal may appear to be, their duty lies clearly in one direction, and one direction only, and that is, to make the most of what they have got.

We have no lack of noble examples to guide us in taking this line of action. Drake's sailors, in small and ill-found ships, in arrears of pay, with scanty provisions, and often fitted out entirely by private enterprise, flinched not from the Spanish Armada, but attacked it, harassed it, and beat it off.

All through the long French war, our ships of faulty construction, and often badly supplied, and manned in great part by "jail birds" and pressed men, were taken to sea and into action, and gallantly fought by their commanders, who allowed no consideration of inadequate means to stand between them and the path of duty.

Then we have Byng sacrificed at the altar of political expediency, "to encourage the others," as Napoleon said; and so it did, or, at any rate, it failed to discourage them.

Then, nearer to our own time we have Sir Edward Codrington made a political scapegoat of, and his gallant action stigmatized as "an untoward event," notwithstanding that he acted strictly in accordance with his instructions.

And then, latest of all, and I might say greatest of all, we have Gordon, alone and deserted, with nought save his own indomitable

pluck and marvellous and resourceful genius, fighting against fearful odds, for many weary months; and finally crowning a career, perhaps the brightest, the most unsullied, the most unselfish, and the noblest which is recorded upon the long roll of our country's heroes, scorning the shameful suggestion to desert those who had been faithful to him, and dying at his post like a true British soldier, leaving not only his own countrymen, but the whole civilized world, to lament his untimely death. But the spirit of his example can never die, and the figure of Gordon, and the record of his life and death, will remain with us and command admiration as long as the English language is spoken, and longer, if men and women still love to honour noble deeds.

With such examples as these before us, it would not become those to whom the country looks for its defence to do more than call attention to the defects and inadequacy of the means placed at their disposal; and having done so, it is then clearly their duty to devote all their attention and energy to the consideration of how they can make the most of what they have got, leaving to their purblind countrymen the responsibility of the disaster which they are courting.

It is with this object that I wish to consider now how we can make the most of our ships.

I propose to commence with our masted and rigged ironclads, which constitute at present a large proportion of the available strength of our fighting Navy, as it will be upon these, and not upon our ships building and fitting, that the first brunt of battle will fall.

Now I am fully aware that a considerable number of our most thoughtful, experienced, and responsible Officers are in favour of keeping a number of masted and rigged ironclads in commission, for the purpose of training their crews to become seamen of the old type. It is argued by these Officers (whose opinions I may observe are entitled to the greatest respect) that if you do away with masts and sails, and the exercises aloft, which they alone provide, you will lose entirely that fine, dashing, active, intelligent, and resourceful individual called the British tar; and that it is therefore worth any sacrifice to keep up the breed as long as possible; and although they admit, or at least most of them do, that the spars, rigging, and sails of an ironclad detract from her fighting efficiency, yet they say it is very easy to throw all these things overboard before an action begins, and transform the ship in a few hours (or a few minutes as they do it for exercise) into a really formidable fighting machine.

There are several points in the above contentions and arguments which I have the misfortune to differ from; and I will state them as clearly and briefly as possible, with the view of eliciting the opinions of some of the younger and less experienced, though perhaps equally thoughtful, members of our profession.

In the first place, I submit that it is not fair to assume, or possible to prove, that if sails were done away with altogether in the Royal Navy, we should be unable to produce a fighting animal quite as good as the present British seaman; considering the sort of ships which he will in future have to fight in. It is quite possible that he may lose some of his more showy and attractive qualities; the collar of his

white frock may not be so neatly cut, or evenly sewn; his trousers may not fit him quite so tightly round the waist; he may have less of a roll in his gait, and be unable to dance a hornpipe; it is even possible that he may give up chewing tobacco, and even swearing, and yet be quite as well able to manipulate successfully the various complicated machines which will constitute for the future the fighting strength of our men-of-war. It is possible that he may become quite unable to haul out a weather earing in a gale of wind, or even to furl a topgallant sail in a breeze; but, considering the supremacy of the British Navy is unlikely to depend for the future upon the smart performance of these evolutions, I do not see that his ignorance (or incompetence if you choose to call it so) in these respects is of any real consequence. I cannot believe that the change of education, to which, in the near future, the British seaman must submit, will have any effect in diminishing his pluck, his endurance, his amenity to discipline, or his devotion to duty. It may, and probably will, detract from his cat-like agility, and his powers of emulating the performances of Blondin: but the question is, are we not now paying too dearly for the retention of these fine qualities? Is it not similar to a desire on the part of our military authorities (if such existed, which happily it does not) of devoting a great deal of time and attention and expense to the study of the science of archery, on the principle that it is a fine manly exercise, and though unconnected with the fighting power of our troops, yet that it opened their chests, strengthened their forearms, and made stronger and finer men of them? It is always extremely difficult to wean ourselves from the fascinations of the glorious traditions of the past; they seize hold upon the imagination and enchain it; they are facts which we love to dwell upon with national pride. The glories of Trafalgar, the Nile, St. Vincent, are of world-wide renown, and it is not disputed by anybody that these, and many other battles, were won in consequence of the superior seamanship of our sailors; hence it is that we fondly cling to the past, and without giving due weight to the totally altered conditions of naval warfare, we continue to lumber up our ironclads with spars, ropes, sails, and a vast amount of nautical stores, which take up valuable space, and are a great expense, for the purpose of training their crews in a species of gymnastics quite unconnected with the fighting power of the ships, or the duties the men would be called upon to perform in action.

The warmest advocates for the retention of masts and sails in our ironclads, and the keeping up of old-fashioned drills and exercises aloft, will scarcely be so bold as to maintain that a ship will ever have to shift a topsail or a topgallant mast in action, or that it will matter one iota whether the crew have been thoroughly trained in those exercises or not. But perhaps the question of expense, and the loss of valuable space which might otherwise be occupied with warlike stores, is not after all the worst evil connected with keeping spars and sails in our ironclads. The fact that it diverts the attention, the energy, and the talents of both Officers and men from the real work of their profession, is probably of more consequence than the

crippling of the ships themselves. The shifting of spars and sails, and the smart performance of the various evolutions of old-fashioned seamanship are so very attractive; everybody can see them, they are visible manifestations of a certain kind of smartness, and have a peculiar fascination for men brought up amidst the traditions of the British Navy. Our Admirals have always highly commended smartness aloft, and our men think far more of a rapid and showy evolution than of efficiency in gunnery, and the study of the real science of naval warfare, which certainly does not consist in the shifting of topsails and the crossing of topgallant and royal yards.

Far be it from me to underrate the value of the spirit of emulation produced by the healthy rivalry between ship and ship at any kind of drill; nor do I underrate the value of the physical or even moral training produced by competitive exercises aloft, but what I do think is that in the totally altered conditions of naval warfare we must set to work to discover some fresh fields for rivalry and competition, more closely connected with fighting efficiency, than the tricky evolutions which now represent the seamanship of our fathers.

A story was told me a short time ago by a distinguished Officer who lately commanded an ironclad which illustrates pretty clearly the undue exaltation of old-fashioned seamanship which I deprecate. The ship he commanded was of novel construction, full of complicated machinery, numerous compartments, and tortuous passages; men used to lose their way altogether amidst the mazes of this iron labyrinth; and knew not what deck they were on, what compartment they were in, or whether they were walking forward or aft: so it occurred to the Captain that if he had to take his ship into action there would be pretty general confusion down below, and that there would be very little chance of his orders being transmitted or attended to, so he set to work in earnest, and with the assistance of his Officers, and by adopting various and ingenious devices, such as painting bulkheads and passages with different coloured paint, and various other novel plans, he succeeded after several months of close personal supervision and attention in evolving order out of chaos, and rendered his ship a valuable fighting machine; but the various and sometimes irksome drills which went on down below by candle-light, and which were so absolutely essential to the fighting efficiency of the ship, made no show; nobody could see from outside what was going on within, and the probability is that the other ships' companies were under the impression that the crew of this gallant ship spent most of their time in sleeping, which impression would no doubt be strengthened when Officers from other ships came on board and saw men emerging from the gloomy depths below, and blinking and winking like owls in the daylight.

Be that as it may, when the Admiral's inspection took place but scant credit was given to the Captain and his Officers for all the pains and trouble they had taken to get their ship into fighting order, and as they could not cross topgallant and royal yards and shift topsails quite so smartly as the other ships of the squadron, they found themselves but lightly thought of, and suffered under the cold shade of

official displeasure. Then the gallant Captain bethought himself that this was unpleasant, and would be bad for the *morale* of his men; so having got his ship into efficient fighting trim and got scant credit for it, he set to work with equal energy to exercise his men aloft, for he had masts and sails too, and in a very short time his ship succeeded in shifting a topsail a few seconds quicker than any ship in the squadron; then she immediately rose from the depths of official displeasure to the highest pinnacle of fame—she acquired the proud title of “the smartest ship in the squadron,” and nothing was good enough for her. This is the end of the story, and I will leave every one to draw his own moral.

Another argument used by those who are in favour of retaining sails in our ironclads is to the effect that if the ship's engines broke down in action, she would be utterly helpless if she had no sails to fall back upon. This sounds very plausible, but how much is it really worth? Does any one suppose that if the “*Minotaur*,” or the “*Alexandra*,” or the “*Hercules*,” or the “*Téméraire*” broke down in action, the use of their sails would prevent them from being rammed or captured? I cannot believe that any one acquainted with the behaviour of ironclads under sail would for one moment indulge in such a delusive hope. These ships will rarely cruize or fight alone; they will almost always be in squadrons, and if they break down and the enemy eventually get the best of the fight they will be towed into a foreign port, for they will certainly not be able to escape under sail, whereas if their own side gets the best of it they will be taken in tow by a friend.

If the sail power in ironclads is of no real value to help them in action, or on a lee shore with engines disabled; if, moreover, it occupies a great deal of valuable space which might otherwise be devoted to warlike material; if it represents a large item as to cost; if it diverts much of the attention of both Officers and men from the study and practice of the real arts of naval warfare; and if the only thing that can be said in favour of it is that it makes our sailors agile and active, and exercises and trains them in the use of certain materials which some years ago were essential to the motive powers of the ship, but which are now as obsolete for fighting purposes as the bows and arrows of the Saxons, or the clubs of the ancient Britons, it may be fairly asked if we do not pay a little too dear for the luxury of keeping up with very partial success the qualities of seamen of a bygone age; qualities which, though very admirable in their way and very attractive, are no longer required for the manipulation of the Whitehead torpedo, or the loading and pointing of a 100-ton gun.

Let us consider, now, how much we could add to the fighting strength of our rigged ironclads if we took all sails, spars, ropes, yards, and everything but their lower masts out of them, and gave them a couple of derricks for hoisting out boats. Take the old “*Minotaur*,” for instance, a ship which is usually looked upon and spoken of as quite obsolete as a fighting machine, and I must acknowledge that a short time ago I was very much of that opinion myself;

but a deeper study of the subject, in view of the extraordinary development of light and machine-gun fire, has caused me to modify, I might almost say reverse, that opinion; and I cannot help thinking that we shall very soon come back again to moderate armour and numerous light guns, and possibly find some of our supposed obsolete ships, when re-engined and re-armed, to be amongst the most powerful fighting ships we have got. I believe that the "fad" of putting two or three guns of great size and small patches of thick armour upon ships of 10,000 tons has been carried to an absurd extent both in our own and foreign navies, but more particularly in our own. It is, I am convinced, a total miscalculation of the chances of a naval battle; it provides for only one remote contingency, namely, that of being hit by a heavy shot in the right place, and it leaves totally undefended large portions of the ship which are equally vital to her safety at sea, and which can be riddled and knocked to pieces by the machine and light gun fire which is certain to hit in a hundred places. No one who has at all realized the rapidity and volume of the fire of the new quick-firing six-pounder and the various machine-guns can doubt that even if the practice is indifferent, and the proportion of misses large, as it probably will be, yet according to the laws of chance there must be a good many hits; but it is not so with the heavy guns, as from the slowness of their fire it is quite possible that it may be some time before they make a hit at all, and then, perhaps, not in a vital place. It is the difference between a chance and a certainty: we try to provide against the chance, but not against the certainty. This seems to me all wrong, and therefore I think that many of our old ships will come to the front again, and if armed with numerous light and machine-guns that they will be more than a match for the new ships with two or three heavy guns and very limited patches of armour.

What would have been thought of a knight of the middle ages who concentrated the whole weight of his body-armour into a helmet of enormous thickness, on the principle that he was'n't going to have his head smashed by any club that ever was wielded, but who left his body exposed to arrows, lances, pitchforks, or anything else they liked to stick into him? Who would be such a fool as to go for his head?

Now the "Minotaur" is at least machine-gun proof, both at her water-line and all over her battery: she could of course be disabled, possibly destroyed altogether, if she were struck in certain places by the shot or shell from a heavy gun, or even by the shot from a gun of by no means the heaviest calibre; her steering gear also is exposed, and she is a long ship, and though handy for her length, must necessarily be somewhat deficient in manœuvring power. These are some of her disadvantages: let us now see what can be said in favour of her, if properly fitted for battle. First of all, I am informed by experts that, without any additional weight, she could now be fitted with engines which would drive her 16 knots, and this speed would make up considerably for her deficiency in manœuvring power. She could carry about fifty 6-inch guns, most of them behind armour

thick enough to keep out light and machine-gun fire. Then if all her spars, sails, rigging, and everything but her lower masts were taken out of her, see what weight aloft would be saved: she could no doubt have all her five tops strengthened and armour-plated with 2 or 3-inch steel armour, without altering her stability or increasing her draught: and she could carry three or four machine-guns in each top, and all the space and weight down below devoted to boatswain's stores could be given up to machine-gun ammunition. Engined and armed like this, the old "Minotaur" and her sisters would undoubtedly prove very formidable vessels. I imagine that at close quarters (which with their good speed they ought to be able to maintain), if they were engaged with a barbette ship, the latter would find extreme difficulty in loading and pointing her heavy guns. The terrific fire which would be kept up from the five armoured tops of the "Minotaur" would sweep the decks, and pour into the barbettes of any ship within five or six hundred yards of her, in such a manner as to render it impossible that any men could expose themselves without the certainty of destruction.

Her fifty 6-inch guns would also keep up a rapid shell-fire, which, although it would not penetrate the thickly armoured portions of a modern ironclad, could scarcely fail to demoralize an enemy. I am one of those who think that it will be impossible to riddle and destroy (perhaps set on fire) certain portions of a ship without seriously affecting the whole structure, even if such destruction does not affect the stability of the ship, which as a matter of fact it does in all our modern ironclads.

It must not be supposed that I am holding up the "Minotaur" as the typical fighting ship of the future: far from it, she has grave defects which might easily, with our present knowledge, be rectified in future designs; but I think that we shall soon come back to that type of ship, in preference to two or three heavy guns and limited patches of armour: take precautions, in short, against the greatest number of chances, and not against one off chance which may never happen; and I may here observe that my views on this subject are shared by many experienced Officers. Personally I look upon the "Inflexible" as the worst armed ship in the British Navy for her tonnage; only fit to bombard forts, but not fit to contend against a ship of her own size, armed with lighter but more numerous guns.

It would appear as if this shrinkage of armour as it is called, that is, the thickening of armour in some places, and the stripping of it off altogether in others, had been carried out under the impression that nothing was going to be fired against a ship in action except guns of the heaviest calibre. If this heavy gun attack only was what we might reasonably expect, then I believe this shrinkage of armour might be defended; but as I anticipate a thousand small shot and shell will be fired in action for every heavy one, I cannot help looking upon it otherwise than as a very risky proceeding; and I submit that we are not justified in continuing it, or in building any more ships on these erroneous principles, in view of the rapid development in all foreign navies of light and machine-gun fire.

It may be said that this development of light gun fire has taken place in consequence of the shrinkage of armour, and is in fact the reply to it. It very probably is so; but then we are bound to reply again, by sacrificing some weights to armour our ends, and by building no more ships of the citadel type.

A short time ago I listened with much interest and attention to two lectures delivered at the Royal Naval College at Greenwich, by a very able official from the Constructor's Department at the Admiralty. The lectures were intended to prove that the English design of central armoured citadel and unarmoured ends was superior to the French design, wherein a greater percentage of the displacement is given to armour-carrying power, and a complete water-line belt, thicker amidships even than the English, is given to the ship, thus assuring her buoyancy against everything but the heaviest guns (though, of course, in neither case does the armour protect against ram or torpedo).

The lectures were illustrated by drawings, and clever but delusive models; and I believe the lecturer convinced the majority of his audience that the citadel principle was right, and that the French completely belted system was wrong: but then the majority of his audience was composed of young men who had never been to sea, students in engineering and naval architecture, who knew nothing whatever about the behaviour of a ship at sea, and who were consequently quite unable to detect the fallacy of the arguments and the illustrations. But I believe I am correct in saying that almost all the seamen of experience who listened to those lectures came away anything but satisfied with the superiority of the English design. Personally I was appalled at the want of reasonable argument, and at the flimsiness and transparent absurdities of the special pleading brought forward in support of the citadel ships.

It is impossible that I should enter now into all the plausible but erroneous arguments, or describe the misleading models which were produced in defence of the citadel type, but I may just mention one, although it was by no means the worst. It was a model of a section of a ship intended to show the power of loose water in extinguishing rolling: the section was suspended on an axis, a short distance above the centre of gravity, I presume at the metacentre, and a glass tube with a little water in it attached to the model showed the extinguishing power of loose water, which nobody doubted; but I need hardly point out to seamen that a model suspended on an axis, and set swinging like a pendulum, bears about the same relation to the behaviour of a ship at sea, as a rocking horse on a fixed arc bears to the motion of a horse galloping. I say I was appalled at the poverty of the arguments used in support of the citadel ships: it is to me quite incomprehensible that any seaman who takes the trouble to look into the matter should accept the statement of their designers, that these ships will be either manageable, fightable, or habitable, with their ends riddled, and five or six hundred tons of loose water washing about in them. I cannot believe it, and until it has been actually tried by experiment, I think that very few seamen will believe it; it is so totally contrary to all our experience.

It is so easy to work out inventions on paper and prove them by models; but it is very well known that there are but few inventions which do not turn out in practice to be something quite different from what they were intended to be. The calculations might have been all correct as far as they went, but a small item, perhaps several small items of the forces of nature, had been unforeseen and not been taken into account, so that the result was quite different from that anticipated: we have only to look at the records of the Patent Office to convince ourselves of the enormous number of failures of untried inventions. It may be said that the citadel ships are not an untried invention, and that their designers can foretell with accuracy what their behaviour will be under various conditions. I cannot accept this statement. Many machines founded on supposed scientific principles have failed utterly in practice; and then *after*, but not *before*, the failure the inventors have been able to put their fingers on the flaw, and explain satisfactorily the cause of failure: and I submit that we are running a terrible national risk by building eleven ships of a novel design, before one has been tried at sea, in the condition which the designers maintain will be safe, but which the majority of naval Officers, reasoning by experience, think will be unsafe.

I have already in this Institution entered at some length into the reasons why I thought the citadel principle a mistake; and although the other side of the question was ably argued, I think that the supporters of the citadel ships failed to convince naval Officers that the French belted system was not superior for seagoing fighting ships.

It is claimed for the more recent ships of the citadel type, namely, those of the "Admiral" class, that they will have a knot more speed than the French belted ships; and no doubt speed is a very desirable quality; but when we are told that they will only lose a quarter of a knot of speed when they are riddled and their ends full of water, we may, I think, be allowed to doubt the assertion. Some experiments were made at Torquay a few years ago, by Mr. Froude, upon a model of the "Inflexible," in order to see what effect upon the longitudinal stability of the ship would be produced if she received shot-holes in her foremost unarmoured end of a certain shape, scoop-shaped holes, such as shot striking diagonally might be expected to produce; and according to the official report, the result of the experiment proved that if the "Inflexible" herself received wounds of this nature in her bow, she would tip dangerously, in fact go down by the head altogether if she tried to steam more than 7 knots. And yet in the face of this we are asked to believe that the 16 knots of the "Admiral" class will be only reduced to $15\frac{3}{4}$ when their ends are riddled and water-logged. It is assertions of this kind which startle us, and cause us to look with doubt on some of the other good qualities claimed for the citadel ships.

The question now is, how can we make the most of these ships? How can we make the best of what we have got? Machine and quick-firing guns have entirely altered the condition of affairs since these ships were designed. It is almost a certainty now that the broad region of their water-line will be pierced in numerous places

by machine-gun fire; and that the consequences will be very serious, as the holes made in thin steel by machine-guns are by no means small.

A 2-inch water-line belt of steel has already been hinted at by the Chief Constructor himself, as a means of keeping out machine-gun fire, the weight to be obtained at the expense of leaving out some heavy gun ammunition. I fully recognize the wisdom of leaving out some heavy gun ammunition, in view of the slowness of fire of heavy guns; but I do not think 2 inches of steel would be enough. We hear a great deal about the value of armoured decks for resisting plunging fire, and preventing heavy shot from going out through the bottom on the other side. This is a contingency which I consider to be very remote, particularly in view of the low trajectory of modern guns, and I think that we pay too dear for the luxury, and that the weight would be better distributed in side armour; it would give side armour of very considerable thickness, and would, I think, provide against a greater number of chances, which is all we can do in any case; and this should always be borne in mind when we are arguing about the distribution of armour, for there is no such thing as absolute safety in any combination.

The French have managed to combine both, a complete armoured belt and a covering armoured deck of considerable thickness. We have distributed our weights otherwise, and, as I venture to think, less wisely; for I do not think that Sir E. Reed's maxim can be repeated too often, viz., that the first duty of a ship is to float; and it is by no means certain that ours will do so under the infliction of very moderate wounds.

The more I study the subject, the more firmly I feel convinced that enormously heavy guns and patches (very limited patches, be it observed) of armour will not govern the designs and construction of our future fighting ships. I think we shall come back to moderate armour and numerous light guns, with perhaps one or two heavy ones, not protected as now with very thick armour. The object will be to keep out the greatest number of shot possible, both from the water-line and from the battery; and we shall give up trying after the impossible task of making any portion of the ships impregnable to the fire of the heaviest guns. We must accept the chance of a heavy shot striking a vital part as one of the chances of war: we cannot escape it.

I do not think that you can smash up and destroy one part of a ship without demoralizing the other parts. It is all very well to talk about a fort on shore being able to lose its outworks, and yet defend successfully its citadel; a ship is a very different affair, and if any part of her during an action either catches fire or develops a tendency to turn bottom up, it will certainly jeopardize the whole structure. The idea that it will not do so appears to exist in the minds of the defenders of the citadel ships, and although they have endeavoured to prove it by means of mathematical calculations, and clever and ingenious models, which remind one of a conjuror's professional apparatus, I venture to think that they have failed to prove it.

I firmly believe that a ship of the "Admiral" class, with her ends

and topsides damaged, will at sea, in ordinary weather, develop eccentricities of behaviour quite as erratic, and probably more dangerous, than that of the "Agamemnon," in her intact condition; which ship, I am informed, with her helm *amidships*, turned a complete circle to port in nine minutes and ten seconds.

Now as I cannot for one moment believe (unless they tell me so) that the designers of the "Agamemnon" intended that she should perform this novel and peculiar manoeuvre on her own account, I am justified in asserting most distinctly that this ship has not proved in practice to be that which her designers intended her to be. Moreover, it is a self-evident fact, which requires no argument to prove it, that some very powerful dynamical forces, which in practice act upon the ship, must have been entirely omitted from the calculations of those who designed the "Agamemnon;" or if taken into account they must have been assigned a false value, which comes to the same thing.

The question, then, which will present itself to the minds of most practical seamen will be somewhat as follows. Is it reasonable to ask me to believe in the safety at sea of a riddled citadel ship, simply upon the unproved calculations of the same people who designed the "Agamemnon" to go straight, but found in practice that she turned a circle in nine minutes and ten seconds, especially when all my experience as a seaman, and my knowledge of the behaviour of a ship at sea, point in an opposite direction?

The title of my paper is, "How can we make the most of our Ships?" But this is a very difficult question to answer in the case of the citadel ships, for in order to calculate how you can make the most of a thing, it is necessary to know how much it is worth already; and this is just exactly what we don't know with regard to them; and as experiments are said to be too expensive, and in fact unnecessary, we are not likely to know until it is too late.

I am informed that the Captain of one of these ships now in commission has been anxiously inquiring the price of chloride of calcium, with the view of carrying out the suggestion made at page 259 of the "Gunnery Manual," namely, to stuff 2 feet of white oakum soaked in chloride of calcium into his coffer-dams, in order to *reduce* the inflow of water into his ship. I also hear that he is going to hang chain cables round inside his coffer-dams, to try and keep out some of the smaller shot; so he is evidently going to try and make the most of *his* ship; but it will strike most people as being a little bit strange, that one of our first-class battle-ships of the present day should have to resort to an old-fashioned dodge, practised more than twenty years ago by a wooden paddle-wheel steamer with exposed engines. But yet the Captain of the ship I speak of is no fool, and knows what he is about.

I have lately been trying some experiments by firing shot through india-rubber, in order to see what the use of it would be as a permanent leak-stopper always in its place: and I may here remark that although the idea was original so far as I was personally concerned, inasmuch as I was unaware that it had ever occurred to anyone

before, yet I found on enquiry that it had been tried on torpedo-boats some years ago, and a patent taken out for it by Colonel Fosbery, V.C. But the patent appears to have been abandoned and the idea dropped, probably in consequence of the difficulty of fixing the india-rubber to the torpedo-boats, the addition to weight, and the reduction of speed it would produce. But like many other inventions, it would seem that it appeared before its time—before the necessity for it had fully arisen. But now that machine and quick-firing guns have been invented, which can pierce the water-lines of our first-class fighting-ships, I venture to think that the necessity for it has fully arisen; but as it is still to a great extent an untried device, I would speak of it with the greatest diffidence, and by no means claim for it that it is a practicable and certain plan for keeping ships afloat; although it is quite possible that I might be able to prove by mathematics that it will do so. I prefer to wait until more exhaustive experiments have been made with it, before I claim for it a place amongst the materials of naval architecture. I may explain that the mode in which I propose to use the india-rubber is by putting sheets of it an inch thick in coffer-dams in the region of the unarmoured water-lines of all ships, as I think it extremely doubtful whether it will stand exposure to the weather, and the wear and tear to which it would be subjected as an outside water-line belt. Its cost would be about 22s. a square foot, and, roughly speaking, it would cost about three or four thousand pounds to do the "Edinburgh's" coffer-dams in this manner—a small item, I venture to think, if it would really keep the water out, and from my experiments I really believe it will under all ordinary fire.

Before concluding, I have a few more words to say of the "Admiral" class of citadel ships, as compared to the French completely belted ships of the "Duperré" class. In the "Admiral" class the partial water-line belt is combined with lowness of belt; and this combination of a low and incomplete belt appears to me to be simply madness, as one of the essential conditions of safety in a low-belted ship with topsides riddled is, that she should be kept very nearly upright; and there appears to be no reason why this should not be done by cautious management in all ordinary weather with ships having a low but complete belt like the French ship "Amiral Duperré." But when the low belt stops short of the ends, and 500 tons of water can be admitted on to the armoured deck by the fire of nothing larger than machine-guns—a condition which it is not denied will probably happen to our "Admiral" class in action—you immediately throw away all possibility of maintaining the one essential element of safety in the low belt (*viz.*, that of keeping the ship upright), in anything but a flat calm and dead smooth water; because the 500 tons of loose water in the ship must run to the lowest side, and increase enormously any heel which even running a gun out would give the ship. Moreover, in the "Admiral" class ("Collingwood," for instance), the belt which was originally only 3 feet above the water (that is to say, the same as the French ship) is now, through the admission of the water, reduced to about one half, or 1 foot 6 inches.

Therefore, although the necessity for keeping the ship upright is double as great, or in other words, although she can only afford to have half the list of the French ship, yet the chances of keeping her upright are enormously reduced by the presence of 500 tons of free water; in fact, I should say that there was not the slightest chance of keeping her upright, or of preventing her from capsizing.

We are told that the greater metacentric height possessed by the English ships will make up for their having only 1 foot 6 inches of armoured freeboard and 500 tons of loose water in the ship. I cannot believe the statement. It may give the model a slight increase in statical stability in the tank in the model room, but this bears but a very slight, and in fact a misleading relation, to the behaviour of the ship at sea; and my belief is that the "Collingwood," if only moderately damaged in her ends and sides above the armour, would inevitably capsize in ordinary weather.

It is really all a question of the *amount* of damage which will capsize these ships; for even their own designers admit that complete destruction, as they call it, of the unarmoured parts will cause them to capsize; but I believe that very incomplete and partial damage will cause them to do so.

Let us now compare the two ships, English and French, and try to estimate their respective chances of floating right side up, under certain conditions of partial destruction of unarmoured parts.

[It was intended to have compared the two designs at this point by means of diagrams.]

It is not denied by anybody that a shot from one of the heavy guns, if it strikes at right angles and point blank range, will penetrate almost any known armour, and perhaps do fatal damage to the ship. This, as I said before, is one of the chances of battle which must be accepted on both sides, the same as the chances of being struck by a torpedo or the ram; but I venture to think that it is a somewhat remote chance, and has nothing to do with the perfect certainty (with present armaments) of ships being hit all over by the missiles from machine and quick-firing guns; and what we really have to take into consideration is the amount of disablement which this sort of fire will cause to different types of ship, and not the chance of a direct blow from a heavy shot, which, it is admitted, may destroy any ship. If this proposition be correct—and I submit that it is the only reasonable way of looking at the question—let us compare the distribution of armour on the "Collingwood" and "Duperré," also the size of vulnerable target which each will offer to light guns, and the consequences to each ship of the partial destruction of unarmoured parts; first observing, that although "Duperré's" armour is greater in extent than "Collingwood's," it is no thinner, but, on the contrary, thicker over the vitals, and therefore more likely to resist heavy shot which strike at angles. This is partly due to the fact that the French have given up a greater percentage of their displacement to armour than we have, leaving out some ammunition, coal, and other things—an arrangement which may or may not be wise; but it is also partly due to the fact that the representative first-class French

ship "Duperré" is 1,000 tons larger than our latest, or "Admiral" class of ships. Now there is no reason that I know of why the "Collingwood" and her sisters should have been deliberately built 1,000 tons smaller than the "Duperré" and her sisters, except on the principle that it is good strategy to have a force slightly inferior to that of your enemy at a given place and a given time. The great Napoleon used to say that the opposite plan was good strategy; but that is some time ago now, and strategy may have altered since then: but even if it has done so, we shall require something more stubborn than strategy to alter in our favour. We shall require some of the fundamental laws of hydrostatics to be altered for us, before our first-class battle-ships can be compared on terms of equality with those of the French.

To continue to build ships of this type appears to me to be unwise, in view of the ships which our neighbours are building.

England is already spoken of, by foreign newspapers, as the "empress of the seas." If war should prove that she is so, her days will be numbered; the British Empire will be broken up, and England herself in all probability cease to exist as an independent Power.

Apart from the technical questions of the designs of fighting ships, the inadequacy of our present Navy to protect the vital interests of the Empire in case of war ought to be a subject of the deepest concern to all Englishmen. It is entirely a question of money; money and time. Will Englishmen have the wisdom to make the necessary sacrifices, and spend the necessary money in time, while the day of grace still lasts? Money enough to re-engine and re-arm our old but still effective ships; and money enough to build a sufficient number of new ones of the most powerful type, to meet the needs of the Empire and to regain our lost place amongst the nations of Europe? Or will they wait until it is too late; blindly put off the evil day, and then spend ten times the money when it is too late to be of any use? We have had many examples to show us that personal bravery and devotion to a cause, carried even to the extent of fanaticism, are no match against organization and the scientific development of the various engines of modern warfare: therefore it is nothing less than blind folly to trust only to the courage and devotion of our soldiers and sailors, and to the vast extent of our undeveloped resources in material. We shall be given no time to develop anything except a panic; and then once more we shall hear the bitter cry of "too late." We shall hear angry recriminations bandied from one political party to the other. The hungry millions of the poorer classes will rise demanding bread for themselves and their children, and declaring passionately that they have been betrayed; just as their neighbours across the Channel did some fourteen years ago. But the horrors of the Paris Commune will pale beside the scenes we may expect in England if ever her sea-borne food supply is cut off, or even seriously interfered with. And this is the catastrophe which we are now courting.

We may search all history in vain for the record of any rich nation, which was allowed by her neighbours to retain her riches for

long without being strong enough and ready enough to defend them by force of arms. We have Divine authority for assuming that the strong man armed will be able to keep his goods in peace for a time at least; but we have no authority, either sacred or profane, for assuming that the rich man unarmed will be able to do so.

Let us then banish from our minds the infatuated idea that in future all national disputes will be settled by arbitration. Small differences, which we do not care much about, may perhaps be so settled: but we have no shadow of justification for assuming that while men's passions and ambitions remain such as they are, the serious and vital interests of nations will be decided otherwise than by the stern arbitrament of war.

The following short extracts from Jomini's "Art of War" appear to me to be pregnant with forcible argument and sound reason; and by the substitution of the word "Navy" for "Army," to be particularly applicable to the England of to-day:—

"When the control of the public funds is in the hands of those affected by local interest or party spirit, they may be so over-scrupulous and penurious as to take all power to carry on the war from the Executive, whom very many people seem to regard as a public enemy rather than as a chief devoted to all the national interests. The abuse of badly understood public liberties may also contribute to this deplorable result. Then it will be impossible for the most far-sighted administration to prepare in advance for a great war, whether it be demanded by the most important interests of the country at some future time, or whether it be immediate and necessary to resist sudden aggressions.

"In the futile hope of rendering themselves popular, may not the members of an elective legislature, the majority of whom cannot be Richelieus, Pitts, or Louvois, in a misconceived spirit of economy, allow the institutions necessary for a large, well-appointed, and disciplined (Navy) to fall into decay? Deceived by the seductive fallacies of an exaggerated philanthropy, may they not end in convincing themselves and their constituents that the pleasures of peace are always preferable to the more statesmanlike preparations for war?"

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"It is doubtless true that whatever increases the prosperity of the country should be neither neglected nor despised. It is also necessary to honour the branches of industry which are the first instruments of this prosperity; but they should always be secondary to the great institutions which make up the strength of States, in encouraging the cultivation of the manly and heroic virtues. Policy and justice both agree on this point; for, whatever Boileau may say, it is certainly more glorious to confront death in the footsteps of the Cæsars than to fatten upon the public miseries, by gambling on the vicissitudes of the national credit.

"Misfortune will certainly fall upon the land where the wealth of the tax-gatherer or the greedy gambler in stocks stands in public estimation above the uniform of the brave man who sacrifices his life, health, or fortune to the defence of his country."