



## Some Opinions of the Whitehead Torpedo and its Relation to Modern Armaments and Tactics

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## SOME OPINIONS OF THE WHITEHEAD TORPEDO AND ITS RELATION TO MODERN ARMAMENTS AND TACTICS.

Compiled by T. J. HADDY, R.N., principally from "Mittheilungen aus dem Gebiete des Seewesens."

NOTWITHSTANDING the advance which has been made in the destructive powers of modern artillery, both for men and material, the Whitehead torpedo still maintains its position as the weapon most feared by naval men. That this fear and apprehension are well founded may be allowed when we recognise that the ordinary 14-in. torpedo, carrying a charge of less than 100 lbs. of gun-cotton, is capable of making a hole 200 sq. ft. in area in the bottom of a well-built iron ship, as was proved in the case of the "Blanco Encalada," in Caldera Bay; it may, therefore, be admitted without question that any ship now in existence, or likely to be built in the near future, would founder almost immediately from the effects of a successful shot by the modern 18-in. torpedo. The torpedo in itself is practically the same in all European navies, and is now being introduced into the American navy, so that, in relation to this weapon, all stand practically on an even footing, although the experts of each country may consider their own weapons more perfect and their methods of using them superior to those of other nations. Unfortunately, the torpedo depends for its success entirely on the correct adjustment of numerous mechanical details, which is a defect almost fatal to its utility as a weapon for naval purposes, where it must be handled and fought by men more or less destitute of any definite mechanical training, and who are generally further hampered by having to use transporting and loading appliances altogether inadequate to the careful treatment of such a delicate machine. The discharging tubes, at least above water, are very similar in all nations, the differences being merely in the details, and they do not affect the general results. As regards submerged discharge right ahead and right astern, the former does not present many mechanical difficulties to be overcome, and has been much esteemed, except, perhaps, in our own navy, from tactical considerations, and from the fact that very successful running can be obtained from it; but its importance does not appear to be so much insisted on as formerly. The astern submerged discharge is reported to have been tried in the Italian navy, as described in the "R.U.S.I. Journal" for August last, but the disadvantages of such an arrangement as is there shown are obvious, the risk of injury to which the outside rudder connections are exposed being one of the most important. It will have been observed also, from what has lately appeared in this Journal, that great efforts are being made by France to obtain a sub-

merged discharge on the broadside which shall be superior to our own, whilst its value has been much questioned by other competent judges, more especially in the Italian navy, and it does not appear at all clear whether a desire and determination to overcome mechanical difficulties has not had as much influence in bringing about its adoption by ourselves as a decided conviction of its tactical importance. An examination into the questions concerning the proper instant for discharging the torpedo under the different angles of training, bearing, distance, course, and speed of contending ships, which have been considered in the "Mittheilungen," is omitted here, as they only involve simple mathematical considerations and are fully considered by all nations in the regulations for the guidance of torpedo officers. The question of vital importance is how to manœuvre your own ship so as to have the enemy at a disadvantage at the supreme moment when the torpedo can be discharged, and, as relating to this question and incidentally to the importance of fixed submerged broadside tubes, the following observations from the "Mittheilungen aus dem Gebiete des Seewesens" may be of interest:—

F. Attlmayr there says, that "the most favourable condition for the employment of the torpedo is that in which the enemy's ship crosses its line of fire, or the direction of its path, at right angles or nearly so, thus offering her whole broadside as a target;" and we may add that the chance of a successful shot will decrease almost directly with the decrease of the angle of transit across the line of fire, and is a minimum in the "end-on" position for a shot from a broadside tube. The direct, or "end-on," position will always come in when ships manœuvre against each other bow to bow, or when one follows the other in the direct line of keel; in both instances the area of target is the minimum, but the distances at which the torpedo can be discharged differ, and in the former case must be large enough to allow time for the discharging ship's course to be altered slightly, so as to enable her to pass clear of her opponent; unless she has perfect confidence in the strength of her own prow to withstand the shock of collision, a confidence which we may assume would be exceedingly rare. This deviation from the direct course must be the smallest possible to effect the desired end, or the ship would be in danger either of a shot from her opponent's bow tube or an attempt to ram. It is very doubtful if such a dangerous manœuvre would be deliberately and designedly attempted with ships at all equally matched, as it would almost surely result in the destruction or disablement of one or both of them. If both ships held on their course, it would largely be a trial of nerve and determination as to which had the best of it; the temptation would be to discharge the torpedo too soon in order to get an advantage over the enemy by having the first shot, and also to minimize the risk of ramming with the torpedo still in the tube, but the chance of an effective shot would be enormously decreased by firing at such a small and angular target at a comparatively long range.

In the case of a ship following another in the line of keel, the distance between them must be very small to give the pursuing ship much chance of using her torpedo effectively, considering that the

torpedo would have to travel double this distance, assuming its speed to be double that of the ship attacked, a fair assumption under actual conditions, and that the torpedo would be very likely to be deflected by the disturbed water in the wake of the ship's propellers. The advantage which the following ship has is that she has the movements of the other under her control so long as she is not considerably over-matched in speed; but the ship chased has every change in the distance between her and her pursuer in her favour, every decrease giving her the opportunity to use her torpedo more effectively, and every increase greater chance of escaping altogether. When a change of course is necessary in order to bring one or other of the torpedo-tubes to bear, it is essential that the torpedo should not be discharged during this change of course, and not until the ship is again steady; also that, if discharged above water, it should be ejected clear of the disturbed water at the ship's side.

When ships are manœuvring at close quarters in order to use their torpedoes, changes of course will be frequent, and neither ship will be altogether free to choose her own movements, as each must act with due regard to her own safety. It must be observed that, however short a time may be necessary for a ship to steady herself on a course after a manœuvre, this will be an important factor in action, as an interval of a few seconds may be of the utmost importance or even decisive. To use her torpedo, a change of course may often be rendered necessary when not imposed on her by other considerations at the moment, and this will be especially the case when she only has a limited number of fixed tubes. As regards the employment of the fixed right-ahead tube, the conclusion on the whole is that, with ships fairly matched and manœuvred, its employment would be purely problematical, the more so as it would be hardly possible that the angle of the path of the torpedo with the course of the enemy would in any case exceed 2 to 3 points, and only when the speed of the attacking ship is very largely in excess of that of her opponent would there be much chance to use the right-ahead tube effectively. The general conclusions from an examination into numerous possible conditions of attack and defence are that the torpedo should only be discharged as before mentioned while the ship is steady on her course, and from this it follows that the possibility of using her torpedo effectively should depend as little as possible on the direction of the ship's course at the time, and that it should in no case be first necessary for the ship to be put in any determinate course in order to use her torpedoes. This object can be attained when the tubes are not fixed, and even if the training is very limited the conditions in favour of using the torpedoes are very much improved, for they are not altogether dependent on the course of the ship; with fixed tubes, three on each broadside are necessary, one on the bow, one on the quarter, and one on the beam; the importance of the first two positions for ships nearing or passing each other on almost any bearing is unquestionable, and it is absolutely impossible for an enemy's ship to come within launching distance of a ship armed as above without coming under the fire of one or other of the torpedo-tubes.

*Independence of the actual course of the vessel at the instant of launching is of primary importance in the employment of torpedoes; if this condition obtains, there is a much greater probability of hitting the enemy without exposing your own broadside to his attack, while at the same time the whole length of the ship attacked may be at right angles, or nearly so, with the path of the torpedo discharged at her. The torpedo may be used in the manner described either as a weapon of defence, for which purpose it may be implicitly relied on, or on the offensive, in which case it will force the enemy to keep at a distance. On the question of what chance a ship has of escaping from the torpedo which she has seen discharged at her, the conclusion is that if the torpedo has been correctly aimed and runs well the chances of escape are very small indeed; the best manœuvre would be for the ship to put her helm hard over and turn away from the enemy, which would have the effect of reducing the area of the target and perhaps of deflecting the torpedo by the disturbed water caused by the action of the ship's propellers; there would be no chance of escape by sudden increase or decrease of speed, the distance being too small and the inertia of the ship too great to be overcome in the time. When we consider the probabilities of the torpedo hitting its object, and the necessary tactics to be adopted for its employment, we arrive at the following important generalizations:—The torpedo is in itself a terrible weapon; one hit may prove decisive; but, to use it effectively, conditions are imposed which are not always in the power of the commander of a ship to obtain. The torpedo, then, will find its sphere of greatest activity when the enemy is not altogether free in his movements, and consequently may form the object of an attack by a preconcerted manœuvre. Also on the unexpected meetings of fleets and squadrons before the tactical formation has been fully decided on, or in the intentional manœuvre of breaking the line of formation by one side or the other, the torpedo may have an important part to play. When the *mêlée* is fully developed, opportunities may offer for torpedo discharge, but regard for the security of the ship will limit its employment to a very large extent. For the rest, the view that the presence of torpedo-boats in the *mêlée* would be the cause of more danger to their own ships than would the torpedoes discharged from the ships of the enemy is not without some justification; under any circumstances, however, great importance must be attached to an effective shot at the first approach of the enemy, as it is very probable that it would have the effect of determining the result of the engagement in favour of the side fortunate enough to make it. In general, it may be said that the torpedo on board battle-ships should be considered rather as a defensive than an offensive weapon, since its employment necessitates an engagement at close quarters, under which conditions the ram also is destined to play an important part, and manœuvres must be avoided which are calculated to afford the enemy an opportunity for this mode of attack.*

*Torpedoes must, therefore, be capable of being used without any, or, at least, with only the very slightest, alteration in the course of the ship, in*

order that any attempt to ram on the part of the enemy may be promptly met; as before mentioned, this object can be attained by the number and arrangement of the launching tubes carried. Only in this way can danger and uncertainty in manœuvre be as far as possible prevented, and any movement avoided which may afford the enemy an attempt to ram, without himself falling a victim to a torpedo discharge; this will be of the utmost importance if a ship should find herself engaged with two of the enemy, as in the case of an attack by breaking the line of formation. If we compare the torpedo with the other weapons forming a ship's armament, it has, as regards the ram, the immense advantage that no direct contact with the enemy is necessary, but within certain limits equal results can be obtained at a distance. The ram also is in the highest degree a weapon of offence, and for its employment the initiative must be assured by rendering the enemy more or less hampered in his movements, whilst the torpedo, if installed on board as we have suggested, may be used without being limited by any such condition; besides which it is not necessarily used only for the attack, but, on the contrary, must be regarded as a most powerful and decisive weapon for defensive purposes. The first principle to be observed in using the ram is to present the bow continually to the enemy, and when possible to turn it against his side; but, to meet this latter manœuvre, an opportunity is afforded for the torpedo if it can be discharged on the bow, either in a slanting direction with the course of the enemy, or as nearly as possible at right angles to it. If in using the ram a ship should succeed in coming down on her opponent within 4 points of the beam, her torpedoes are not much to be feared, but in this case also the discharges should be so arranged that the torpedo could be employed to meet the attack. Great handiness is of the first importance for ramming manœuvres, but not so much so for the torpedo if the ship is adequately supplied with launching tubes properly arranged; the latter condition is of special importance for ships which require considerable room to turn in.

As regards artillery, the torpedo is exclusively the weapon for close quarters, artillery is both for fighting at close quarters and at long distances. The accuracy of the gun is incomparably greater than that of the torpedo, and its employment far less dependent on the manœuvring of the ship and the state of the sea, but against this it must be allowed that as a rule a successful torpedo discharge would have far more disastrous results for the enemy than one or more hits by the gun, according to the nature and weight of the projectile. What we must here, however, especially emphasize is the consideration that the importance of the torpedo, if discharged from above water, may be considerably lessened, if not altogether nullified, by the artillery; and this method of discharge therefore claims our closest attention and consideration. Against the heavy guns of comparatively slow fire, the speed of the ship may afford a slight but insufficient protection, but it is far otherwise in the case of the quick-firing guns, especially the quick-firing guns of large calibres now in use; against which only comparatively thick armour can

afford any protection whatever. We need not reflect only on the work of destruction which such guns are capable of effecting far beyond the range of the torpedo, but also on the moral effect on the unprotected or insufficiently protected torpedo crews, who have to handle the torpedo under the heavy fire of such weapons as are now carried in modern ships-of-war. However much it may be desired to have torpedo-tubes capable of being trained, this object must be given up when the difficulty of sufficiently protecting them cannot be overcome. We must then have recourse to fixed tubes and find a remedy, as we have already frequently observed, in their numbers and the method of installing them.

The following remarks of F. Attlmayr deal exclusively with the torpedo and quick-firing guns of large calibres, and for the purpose of fixing the ideas, he describes the probable course of a duel between a ship A, which relies principally on her powerful armament of quick-firing artillery, and another ship B, which pins her faith on her torpedo equipment. A will endeavour to keep B at a distance and position in which she would be subjected to the most effective fire of the quick-firing guns, until she is so far disabled that a nearer approach might be risked without danger from her torpedoes; this will necessitate an almost similar course to that of the enemy, A approaching and receding from B as occasion requires in order to maintain the above relative positions and distance, and B, on her part, would endeavour to come within launching distance of A as quickly as possible, at the same time taking care not to expose her broadside during the approach. This could be effected most quickly by B coming down on A in an opposite, or nearly opposite, course, and this she would take the first opportunity of doing; she would thereby also prevent A from using her artillery under the most effective conditions, seeing that direction and range would be rapidly changing. By this manœuvre it is inevitable that B in passing will present her broadside to A, and run the risk of having her above-water discharges damaged; but, on one side, it may be said that the ships will pass each other in a few seconds, even at moderate speeds (for instance, in 10 secs. if both ships have a speed of 10 knots), and, on the other, that B will discharge her torpedo before she is abeam of her opponent. If B uses a fixed tube on the bow, or a training tube, there is no question about her discharging her torpedo before coming abeam of A; but if she has to use a fixed tube on the beam, she will have to carefully calculate the speed of the enemy and that of her own torpedo, and shape her course to pass A at such a distance as will enable her to use her torpedo before she is abeam, without risk of a lost shot by the torpedo passing ahead of A. The speed of A, for instance, is 12 knots, that of the torpedo 13 m. per second; in this case B can discharge her torpedo a ship's length (say, 100 m.) ahead of A if she is at a distance of something over 200 m. or  $1\frac{1}{2}$  cables when abeam. If, however, only one torpedo has taken effect, the further course of the struggle can be decided and the ram come into action instead of the torpedo. We will now enquire in what way and to what extent these tactics of each ship can be realized. A and B sight each other; B shapes

course against A, and comes down on her at full speed; A, on the other hand, allows herself to be chased, and B will endeavour to hold her position astern of A so as to avoid the combined fire of her broadside and right-astern quick-firing guns; this A will try to counteract by increasing speed and altering course, so as to bring as many guns as possible into action; this will result in the ships following either a curved or zig-zag course, according to circumstances; A will cover more ground than B, as B only has to keep her head constantly directed against the stern of A at every change in her direction. From this it follows that, if both ships are equal in speed, B will gradually overhaul A, but so slowly that the latter may reckon on effecting her object in spite of the fact that she has not been able to use her artillery to the greatest advantage. If, however, B is efficiently protected by armour forward, and her torpedo-discharges also protected and isolated from each other, the chances of success for her are undoubtedly greatly increased, but not assured; for B must, as before pointed out, approach very close to A (to within about 200 m.) before she could count on a successful shot with her right-ahead torpedo-tube previous to presenting her broadside to her antagonist. At this instant it would be of great moment to B that she should have a tube on the bow; this is under all conditions an advantage, but especially so when, after firing the right-ahead torpedo, a change of course is necessary; and, as above described, a tube in this position may even be of greater importance than one right-ahead. As regards A, the best position for her would be on the quarter of her opponent—of course out of torpedo-range and within effective gun-fire; she would then have a better control of her own movements, and B would be less free in hers; this position would only be dangerous for A if she is much inferior to B in speed, when the possibility must not be entirely left out of consideration that B, in order to have an effective shot with her torpedo, will approach so near to A that the latter will also run the risk of being rammed by her. It can therefore be allowed, as a rule, that A will promptly alter course to the opposite direction when she perceives that an approach within launching distance of B cannot be avoided; and that the right time for this manœuvre will be such that she is still beyond launching distance after completing it. It is not likely that B will alter course at the same instant, as she would give up her advantageous position, and could not use her torpedoes while altering course, supposing she should find herself within launching distance of A during the manœuvre.

As regards the broadside torpedo-tube on the beam, it must be borne in mind that, in order to use it, B, according to the distance, must have reached a position either before or abeam of A. To reach this position, however, B requires time, and it is not a question of seconds, as when passing on opposite courses, but of minutes; for example, in the previous case, if the speed of B is 15 knots against the 12 knots of A, more than a minute will be required for B to reach a position abeam of A from a position just astern, that is, to gain half a ship's length. If, instead of overhauling A, B should endeavour to use her beam tube by altering course, she can only do so when she is



very close indeed to A, and then only when she is steady on her course. By this manœuvre, also, B presents her broadside, and A can, if she thinks the opportunity favourable, and so desires, keep away from her. As may be gathered from the foregoing, the position of A is a dangerous one, if broadside torpedo-tubes on the beam come into operation, should she be overhauled by B, but not so dangerous as to preclude any hope of the final result. The position is much worse for her if B carries a right-ahead discharge or one on the bow; in this position, as already observed, B's ram may come into play, and, considering her superior speed, the position of A becomes something more than serious. It is therefore advisable, when A's speed is not, at least, equal to that of B, that she should avoid the risk of such a dangerous position by a timely alteration of course. If A, by allowing herself to be chased, discovers that she is not equal in speed to B, she should, by changing course at the right distance, endeavour to pass B outside launching distance, and as nearly as possible on an opposite course, repeating the manœuvre as often as B herself alters her direction; but should she find it not in her power to effect this, she should lay B aboard as close as possible, or attempt to ram her, and in this way, by compelling her to frequently alter her course, prevent her from using her torpedoes. It has been said that for A the best position is on B's quarter; it remains to be explained how she can get into this position, and it appears that this would only be possible if B is badly manœuvred or is much inferior in speed to A, but, the position once obtained, it could be held, whatever course B might take. It is clear, from the illustrations we have presented so far, that B would not often approach A at launching distance in the manner and in accordance with the principles we laid down at the commencement of this discussion; this would only be the case when the ships approach each other in opposite, or nearly opposite, directions. In general, the same principles will hold good in engagements between fleets of ships as obtain in the duels of single ships, and the same method of illustration may be used; A representing the fleet whose strong point is the possession of numerous quick-firing guns of large calibres, and B the fleet whose strong feature is the perfection and completeness of its torpedo equipment. A great deal of the argument, as regards the employment of the quick-firing guns only, against the torpedoes only, would lead us into a repetition of what has been considered already in treating of the duel between the single ships A and B, and, as such limited conditions are not at all likely to occur in actual warfare, it will be better to proceed at once with what our author has to say when the heavy guns are brought into play. "We may start with the permissible assumption that both fleets will be provided with heavy artillery, but if the guns of B fleet are so arranged that they can be used in the direction of its course or within a very small angle with it, it will have an immense advantage over A fleet, whose guns are not so arranged, seeing that the A ships must present their broadsides to the bow or 'end-on position' of the B ships, with a much greater probability of the former being disabled by a lucky shot from one of the

heavy guns during the attack than is the case with the latter. A will then do well to avoid such an attack by B as is here supposed (a direct onset) by a timely change of course in the same direction; the general conclusion is that, if the fighting range is not greater than 2,000 m., the risk of loss to which that fleet is exposed which seeks to engage the enemy by direct attack does not appear to be so great as to put any such manœuvre entirely out of the question, seeing that under such conditions it will not be purely a question of artillery on either side. When it is desired on both sides to limit the engagement to an artillery duel alone, the result will be that the courses of the fleets and the speed of the ships on each side will be maintained approximately alike. The fleet which is weak in artillery will, on this account, endeavour to close with the other at a favourable opportunity, when the distance is suitable (i.e., inside 2,000 m.) by altering course and increasing speed. Each side, must, therefore, be on guard against such an attack; a distance of 2,000 m. does not allow much time to carry out a manœuvre by signal from the leader to meet such an attack by the enemy, especially when we consider that, by reason of smoke, extension of the line, &c., communication by signal may be difficult, and under such conditions a delay of a minute would be of the highest importance; for this reason, it follows that Commanding Officers of ships should be instructed beforehand how to act when they find themselves placed in such circumstances. When a fleet consists of a large number of ships, although the plan of attack involves the use of artillery alone, they should be divided into sections or divisions, tactically independent so far as the united action of the fleet will permit. Commanders of divisions must, then, be permitted to act independently in difficult circumstances, when it appears probable that a certain plan of action will tend to bring about a favourable result; by this means, the dangers may be avoided and difficulties met which an involuntary *mêlée* must bring with it. Rear-Admiral Long, in his article 'On the Probable Influence of Quick-firing Artillery on Naval Tactics and Ship Design,' says, 'Such a condition as this (*mêlée*), which presents to our view a disorganized mass of ships, can only be a temporary one with a disciplined navy, and, even then, can only happen when all the leaders have fallen in action, and the means of communication have been interrupted.' We must maintain, on the contrary, that such a state of affairs can only be prevented whilst the fleet is completely master of its own movements, and, therefore, the fight is carried on at such a distance that the whole of the artillery of the ships is not yet fully brought into action. If the enemy is in close formation, the ships at 2 cables distance, the collision of the fleets by an attack such as is here treated of could not take place without the order of the ships being disturbed on both sides, with the difference, however, that the attacking fleet intentionally, and with a view to a certain end, breaks its formation, whilst the fleet attacked is forced into it and obliged to have regard, not only to the movements of the attacking ships, but also to the manœuvring of its own ships, ranged astern of each other, so as to avoid collisions. If the attack is directed against one point of the

enemy's formation, the ships at the point attacked must alter course, either towards the attacking fleet, if there is sufficient room, or away from it; in close formation, an attempt to ram will necessarily result from this mode of attack, but it will hardly afford an opportunity for using the torpedo, and the fire of the ships will probably be considerably limited by regard for the safety of their own side. In the 'front formation' of the enemy this disturbance will extend more or less to the wing ships; with 'head and stern' formation, which is here principally considered, the ships astern of the point of attack will be first in difficulties, as their way is checked and they are forced to break out of the line, whilst, on account of their own and the opposing ships, their choice of a course is not always a free one. The ships ahead of the point of attack would also hesitate in their course, in all probability, and not persist further in one that would withdraw them from the field of battle. The fire of manœuvring ships, however, it should be noted, would not be fraught with so much danger to others as would that of ships on a steady course. It is, therefore, not so certain as Rear-Admiral Long appeared to think, that breaking the line of formation would be effected at the cost of drawing a superior artillery fire on the attacking ships. Many shots do not always mean many hits, and rapid firing brings with it a decreased probability of hitting; even by the employment of so-called smokeless powder a disturbing smoke cloud is not altogether avoided. The value of quick-firing guns does not lie alone in their rapidity of fire, but rather in the fact that with them every favourable opportunity can be seized, seeing that they are constantly ready for use at a moment's notice.

"To consider briefly the conclusion of the question how far quick-firing artillery may replace the above-water torpedo-tubes, it is clear from what we have said that the employment of such torpedoes, leaving chance out of the question, must depend on two conditions—viz., before everything else an effective armour protection both for the ship and the torpedo-tubes, and, secondly, an exceptionally high speed for the ship. These necessary qualifications are also identical with those required for a successful ram, so that, as already observed, the torpedo is only the final and perfecting weapon of a ship designed more particularly for this mode of attack. When both these qualifications, especially the first, are not fulfilled or not possible of attainment, it would be better to do away with the torpedo-tubes above water, and substitute quick-firing guns of large calibre, which do not necessitate an approach to within a few hundred metres of the enemy. The introduction of such guns as above has increased the value of armour protection for cruisers, and we may here state, as our opinion, that cruisers without such protection, the vital elements of a battle-ship, are useless for any task whatever in which they may be called to hold their own in promiscuous fighting. Unprotected cruisers are of value only when they have an extraordinarily high speed, and then only when the field of action is a limited one. As regards the armament of such unprotected cruisers, great weight should be given to right-astern fire. Quick-firing guns certainly have not yet been proved in earnest, and as yet do not exceed about 6 ins. in

calibre, so that it may happen that the great expectations formed of them will not be realized in practice. Common prudence and foresight, however, must admit the probability that they will play a very prominent and important part in future amongst the weapons of naval warfare."

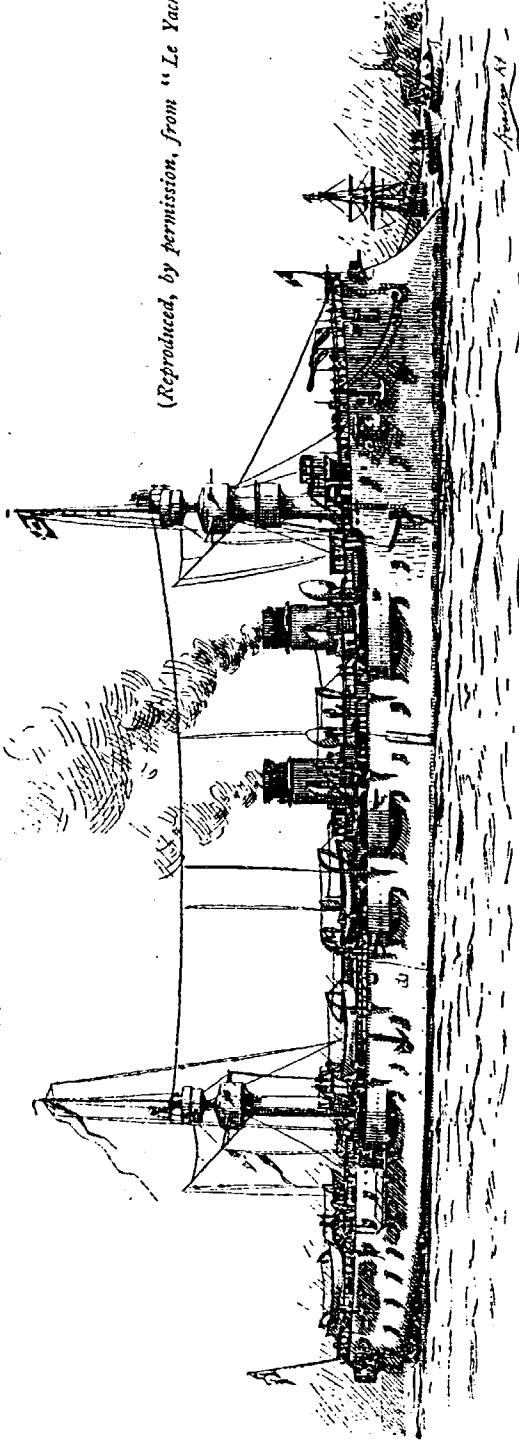
No doubt there is much that is debatable in the foregoing, and to many it may appear useless to theorize on the probable course of naval engagements between single ships and fleets without any definite experience as a starting point. But it is certain that the capacity for destruction of modern artillery and torpedoes, as also of the ram, cannot be over-rated, so that it is in the highest degree improbable that any two ships equally matched would be able to withstand for many minutes a duel at point blank range with all their weapons of attack in a serviceable condition. It appears that this consideration very largely detracts from the value of the torpedo as a weapon for battle-ships and large cruisers, seeing that it would only be used to complete the destruction of an already beaten and practically powerless foe. The state of the question as regards torpedoes, according to the opinions of the various naval experts of different nations, may be broadly summarized as follows:—

1. That torpedo-net defences are impracticable and useless as fitted on board modern ships, being only dangerous encumbrances and forming no efficient defence against the torpedoes now in use.
2. That torpedo-tubes above water, if unprotected, would almost certainly be put out of action in a short time by modern quick-firing guns at short ranges.
3. That protected ships carrying heavy artillery would hardly dare to approach each other within launching distance until the artillery fire of one or both of them had been greatly weakened.
4. That a fixed tube on the beam, whether above water or submerged, is, from a tactical point of view, the least likely to be required in action, and that all broadside tubes should be capable of some degree of training.
5. That the effect of the introduction of quick-firing guns of large calibre is to limit the employment of torpedoes to small ships and boats of very high speed specially adapted for swift, sudden, and secret attack.

As regards 2, we may add that the torpedo crews also would be annihilated, for experiment has shown that nothing could live if exposed to the shell fire of quick-firing guns for a few minutes only.

The conclusion from all this is that the displacement of large ships can be utilized to the best advantage by giving them, 1st, the greatest possible weight of artillery in the shape of numerous quick-firing guns of large calibre; 2nd, the most effective armour protection possible for the crews of these guns; 3rd, speed and large range of action; 4th, that torpedoes are only absolutely necessary for ships of special design, such as rams and small vessels of extraordinary speed.

THE FRENCH 1<sup>st</sup> CLASS CRUISER "ISLY," FROM A DRAWING BY M. KERVERN.



(Reproduced, by permission, from "Le Yacht.")

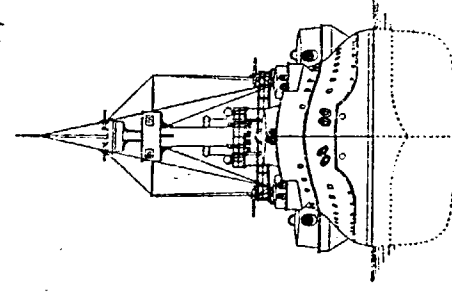
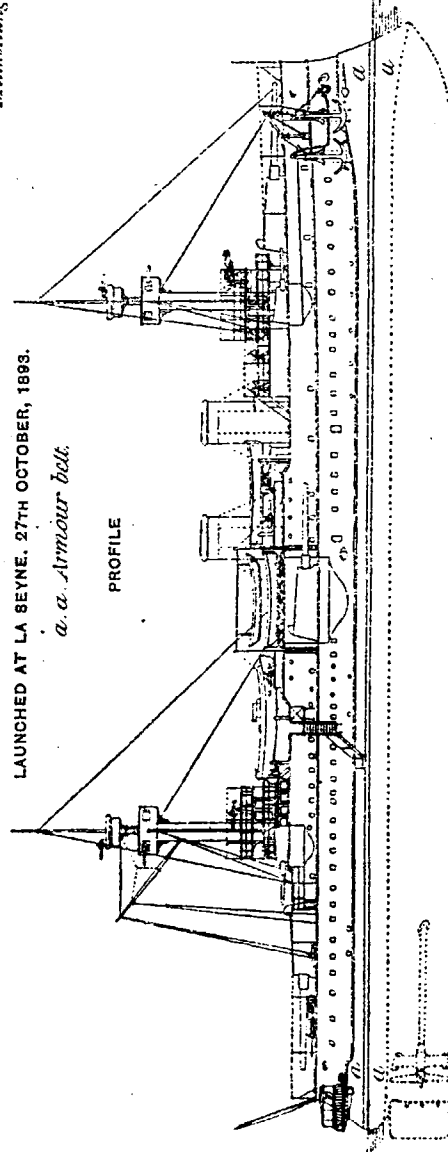
THE FRENCH 1<sup>st</sup> CLASS BATTLE-SHIP "JAURÉGUIBERRY."

(Reproduced, by permission, from the  
"Mittheilungen aus dem Gebiete des Seewesens.")

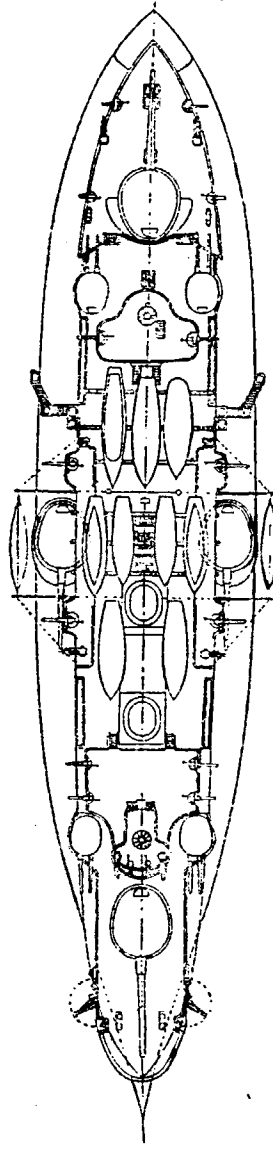
LAUNCHED AT LA SEYNE. 27<sup>th</sup> OCTOBER, 1893.

a. a. Armour belt.

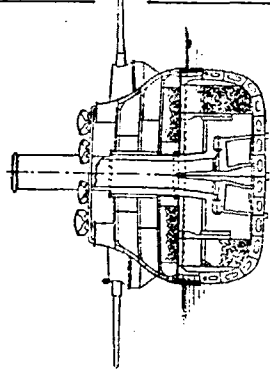
PROFILE



BOW VIEW.



DECK PLAN.



MIDSHIP SECTION.