

CHAPTER III

THE FUTURE OF NAVAL WARFARE

SINCE the time of the Franco-German war certain principles have been advocated in relation to maritime warfare which, if practised, involve a return to the conditions of barbarism. The advance which has taken place in that period in naval affairs is interesting not only in itself, but also because of the influence which it must exert on the character of war on land. The possibility of the destruction of maritime towns, the interruption of oversea supplies, and the severing of certain states from communication with the rest of the world may awaken dangerous movements and cause the stoppage of a war on land earlier than the results expected have been attained. But a naval war between two European powers with equal fleets is improbable, since it would result in mutual destruction.

With the wars of the past, again, no comparison could be drawn. In view of the immense influence which a naval war may exert on the economic and social conditions of peoples, it might be expected that all questions connected with the building of warships and their operations had already been submitted to careful study and consideration. But it cannot be said that this has been done. In France, still dreaming of vengeance, every investigation which would emphasise the ruinous consequences of maritime war in its new conditions is unpopular, since such investigation would unquestionably lead to the conclusion that it will be almost impossible to carry on a war on dry land so as to realise the first hopes. In Germany, maritime war is treated of only by specialists, who restrain themselves in

the expression of views as to the ruinous results which war might involve. Exceptions to this rule are few. Among their number may be found the economist Rudolf Meyer and Admiral Werner. In Italy, the Government is generally condemned for the intolerable burdens to which the people are subjected for the maintenance of armed forces generally, and in particular for the maintenance of the fleet; and it is the interest of the Government to prevent the circulation of pessimistic views. Russia and Austria concern themselves little with maritime warfare, since for them these questions are of secondary importance. England is an exception, and much interest is taken there; and this is natural, both on account of her geographical position and because her population depends directly upon oversea supplies.

But even in England no clear idea of the recent revolution in methods, and of the consequences of a naval war, has yet penetrated to the masses, and the assurance of specialists is accepted that between the naval warfare of the present and the past no fundamental difference which would exclude comparison exists.

In order to establish a contrary proposition, a searching study of the methods which have been prepared for naval warfare would be necessary. Without this it is impossible to estimate the significance of the change. But a popular description of systems of attack and defence at sea presents even greater difficulties than the description of war on land.

To give an idea to laymen of the mechanism prepared for maritime war to-day, and to facilitate comparison with the mechanism employed in the past, it is necessary to compare the growth and perfection of fleets, and the methods adopted for their utilisation by different states. In such a comparison we find a peculiar circumstance which greatly increases the complexity of the subject. In the comparison of armies we deal with a quantity of similar units—soldiers, artillery, and horses. But for the comparison of the fleets of the different powers at different times, we have to deal with varying units, since not only

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the armaments of ships have changed, but the very type. Many suppose that a single modern ironclad, a single swift cruiser with long-range weapons, supplied with explosive shells, will be able to accomplish work for which a squadron would formerly have been needed.

With the adoption of steamers for naval warfare, sailing ships gradually disappeared from the composition of navies. Yet as late as the beginning of the Crimean war the Black Sea fleet counted only 7 steam-frigates, of 1960 steam-power, armed with 49 guns, the remainder of the fleet being composed of sailing ships. The allied fleets contained the following number of steamers: England 24, of 5859 steam-power; the French 12, of 4960 steam-power. The number of guns on the Russian fleet was about 2000, and on the allies 2449. The impossibility of sailing ships accepting battle with freely manœuvring steamers was then fully demonstrated, for the greater part of the Black Sea fleet was destroyed. It is not to be wondered at that the Baltic fleet, composed of weakly constructed vessels, made even a less successful show against the allies.

After the close of the Crimean war the Ministry of Marine actively undertook the construction of a steam fleet for the Baltic, as in accordance with the Treaty of Paris the destroyed Black Sea fleet was not to be rebuilt. This work was carried on in the spirit which generally characterises an epoch of reform. But, owing to want of experience, the new vessels did not answer requirements, especially in respect to long distance steaming. The programme of construction had not been fully executed when armour began to play such an important part in the building of warships that the wooden ships then building lost their value as fighting units.

At the end of 1870, when Paris was besieged by the Germans, the Russian Government, in view of the political changes taking place in Europe, declared that it no longer regarded as binding the articles in the Treaty of Paris relating to the keeping of warships in the Black Sea. But the new Black Sea fleet had hardly been built before the war of 1877 broke out, and the fleet had no influence

on the course of operations, although the Russian sailors distinguished themselves by exploits, and destroyed several Turkish vessels.

The first appearance of armoured ships dates back to the time of the Crimean war. The bombardment of Sevastopol by the combined Anglo-French fleets showed the allies that their wooden vessels might easily be set on fire and destroyed, in a battle with fortresses. The consequence of this discovery was an attempt to protect vessels with iron plates, and in 1854 France began the construction of three armoured floating batteries destined for attack upon the Russian coast fortifications in the Black Sea. The English, with the intention of attacking Cronstadt in 1856, constructed seven floating batteries. The Russian shells directed against these batteries only occasioned damage when they accidentally fell into the embrasures. From this the conclusion was drawn that if vessels were built well protected with armour, and able to manœuvre freely in the open sea, they would be indestructible.

In 1858, by order of the Emperor Napoleon III., the building of the first armoured frigate *Gloire* was begun on the plan of the celebrated engineer Dupuy de Lome. This frigate, in the words of its builder, was to be "a lion in a flock of sheep." The cost of construction reached £280,000—that is, almost three times the cost of the greatest line-of-battle ships, but in view of the immense results that were expected, this outlay was not considered extravagant.

The initiative of France was quickly imitated both by England and America. The deciding circumstance, however, which led to the final supersession of wooden ships was the American Civil War, when the exploit of the *Merrimac*, and the subsequent battle between the *Monitor* and *Merrimac* showed the ineffectiveness of wooden ships, and the immense power of resistance of armour.

This change acted most disadvantageously for Russia; the new steam fleet had only just been completed, and the need for re-building came when, as a consequence of the

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Crimean war, the finances of the country were in a desperate state. But to delay was impossible, and fresh events emphasised the necessity for proceeding with the new construction without delay.

As is well known, Russia in the sixties was threatened with a rupture with the Western powers over the Polish question. In 1863 a committee was formed under the presidency of General-Adjutant Kruizhanovski to consider the measures necessary for placing Cronstadt in a position of defence. The general opinion of that committee was, that with the resources possessed by the enemies of Russia in 1863, Cronstadt could not be defended, and considering the skill and persistence of the enemy even the capital could not be considered safe. The committee found that by means of coast fortifications alone, without mobile defences consisting of forty floating batteries, monitors, and gunboats, the defence of Cronstadt would be impossible.

While vessels of war were constructed of wood, the materials and the capacity to work them were found in Russia. The case was otherwise when iron vessels had to be built and equipped with costly machinery and weapons. Nevertheless, considering the financial difficulties, energetic measures were taken to construct an armoured fleet.

Meantime the other maritime powers, recognising that they were almost defenceless without increase of their fleets of armoured vessels, began with feverish activity to attempt to attain what is apparently unattainable—that is, to build armoured vessels which would resist the action of the strongest artillery.

Not one of the details of naval affairs, not even the construction of ships, presents such amazing results in the way of novelty and improvement as have been attained since 1860 in naval ordnance. The best idea of this may be given by a contrast of the armaments of the Russian fleet of to-day with its predecessors. We will take the old 84 *Prokhor* and the modern *Piotr Veliki* which carries only four 12-inch rifled guns. With one discharge of its

guns the *Piotr Veliki* develops three times the power of a similar discharge from the guns of the *Prokhor*. The whole 84 guns of the *Prokhor* if they could be directed at once in one direction would not cause the slightest damage to the armour of the weakest of modern armoured vessels, while every shot fired from a distance of 7000 feet from the modern 12-inch rifles against the strongest of modern ironclads, will penetrate the side 3 feet thick and protected by a 13-inch plate. In addition to this, all four weapons of the *Piotr Veliki* might be directed against a comparatively small space of the ship's side. But even these guns will be powerless against some of the ironclads now under construction, which are protected by 20-inch and even 24-inch steel armour, and, in consequence, by the side of these armour-clads will be invented even more powerful guns. The more perfect the guns the stronger the armour which has been produced for protection against them. This struggle continues even at the present day.

For employment against armour, steel projectiles were made, and the force of the impact increased ; thus in turn calling for stronger armour, against which still more powerful projectiles are employed. A rivalry in invention began. Sometimes armour was uppermost, sometimes projectiles. But no one listened to the voice of the economists who foretold the consequence of this rivalry. To illustrate this we may cite some figures as to the cost of modern vessels of war. The cost of a first-class line-of-battle ship, impelled by sails, did not exceed £115,000. The building of the first English ironclad *Warrior* in 1860 entailed an outlay of £350,000. But this was but the beginning in the growth in the cost of warships. The German ironclad *Koenig Wilhelm*, built in 1868, cost £500,000, the Italian *Duilio*, in 1876, £700,000, the *Italia*, 1886, £1,000,000. Thus in twenty years the cost of ironclads increased three times. A great part of this outlay is swallowed up by armour. Of £840,000 spent on one of the latest ironclads, *Magenta*, £600,000, that is, 71 per cent., was spent upon armour.

Let us examine the instruments of destruction of these

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maritime giants. A battleship of the old type of the first rank was armed with 120 guns, weighing 480 tons. The first ironclad carried only 32 guns, but these weighed 690 tons. On the ironclad *Italia*, built in 1886, were carried only 4 large and 8 small guns, yet they weighed nearly double as much as the 32 guns of the first ironclad, namely, 1150 tons. Thus since the days of sailing ships the weight of guns has increased more than 150 times. The size and weight of ammunition has, of course, correspondingly increased, and also the destructive force of explosive shells. The diameter of the shells of the ironclad *Warrior* was approximately $6\frac{1}{2}$ inches, its weight 70 pounds; on the armour-clad *Italia* the diameter is increased to 17 inches, and the weight to 2000 pounds. In the course of twenty years the power of a shell, taking only its weight into account, has increased 30 times.

It must not be supposed that this is the limit. England continues to stand at the head of the states who seek for improvements in weapons of destruction at sea. Some years ago English ships were armed with guns of a calibre of 12 inches, and armour nearly 12 inches thick. At a later time they carried guns with a calibre of 16 inches, weighing 80 tons, and throwing a shell weighing 1760 pounds. But in view of the fact that Italy had armed her ironclads *Duilio* and *Dandolo* with guns weighing 100 tons, the English consider a project of building 200-ton guns which will throw a shell of nearly three tons weight, and pierce armour $35\frac{1}{2}$ inches thick.

What is the outlay on the use of such weapons? *Le Progrès Militaire*, on the basis of statistics taken from the French naval budget, makes the following estimate. The firing of a shell from a 110-ton gun costs £166, which corresponds to a capital of £4160. This sum is thus apportioned: £36 for 990 pounds of powder, £130 for the projectile, total, £166. But this is not all. A 110-gun will stand only 93 shots, after which it becomes useless for further employment. As the cost of such a weapon amounts to £16,480 it appears that with every shot fired the value of the arm diminishes by £174, from which

we find that every shot fired will cost £340. Thus with every shot is thrown away the yearly interest on a capital of £8500. A thousand of such shots would represent a capital of £8,500,000.

Passing to arms of smaller calibre it is shown that a shot fired from a 77-ton gun (the cost of which is £10,000, and which will stand 127 shots) costs £184, a shot from a 45-ton gun (which costs £6300, and is useless after 150 shots have been fired) amounts to £98. Only the lives of the sailors on fleets are considered as valueless.

General Pestitch draws a very interesting contrast. He says: "Six Russian ships taking part in the battle of Sinope were armed with about 600 guns, out of which the 300 guns employed destroyed all that was in Sinope, yet the cost of these 300 guns, in the values of that time, did not exceed the cost of a single modern 100-ton gun. What results are to be expected from one weapon which in an hour may be fired no more than five times?" An answer to this question it seems can be given only by a future war. The guns on modern battleships will be able to bombard ports, fortresses and towns, as many specialists declare, from a distance of nearly seven miles.

But this increase of power has not been restricted to battleships alone. Many specialists consider it more advisable to build light and swift cruisers with powerful armaments, and torpedo boats which move almost unnoticed through the water with the speed of a mail train. As soon as the construction of ships was perfected to such an extent that England was able to place on the sea a considerable number of ironclads, armed with powerful guns, and protected by thick steel armour, the question naturally arose: Would it not be possible to direct mines underneath these immense ships, and destroy them by means of powerful explosions in the vicinity of weakly defended parts? For a long time the application of this idea was unsuccessful, many obstacles had to be overcome, and only in recent times has the question been successfully resolved. Then began the construction of vessels specially designed for the purpose of discharging torpedoes. Ex-

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perience showed that vessels discharging the torpedo ran no risk in employing a mine of 55 to 66 pounds of powder, 13 to 15 pounds of dynamite, or 22 to 27 pounds of peroxylene, if it be not less than $19\frac{1}{2}$ feet distant from the place of explosion, the mine being at a depth of 7 feet. Since from $19\frac{1}{2}$ feet distance there is little difficulty in directing a torpedo against an enemy's ship by the use of a pole, the problem became simply how best to build vessels which would be unnoticed on approach. In the Russo-Turkish war of 1877, out of nine cases of attack by Russian torpedo boats the Turks lost one ironclad and two steamers, while three ironclads were injured. The loss in men is unknown. On the Russian side three torpedo boats were injured, also three steam sloops, while one torpedo boat was sunken. Two sailors were killed and ten wounded.

Similar results were obtained in the time of the French-Tonkin war of 1885. Two ordinary steam cutters, not more than 46 feet in length, armed with torpedoes, on the night of the 14-15 February, 1885, attacked a Chinese frigate of 3500 tons and sank it. This frigate was hidden in the harbour of Shein under the cover of fortifications, but the French Admiral Courbet was at a distance of several knots from this harbour. Hidden in the darkness the French cutters covered the distance unnoticed, and after destroying the Chinese ship returned uninjured to the admiral's flagship.

The history of the Chilian war presents a similar case, when, after an attack lasting no more than seven minutes, the Congressionalist ironclad *Blanco Encalada* was sent to the bottom.

From this is evident the immense danger with which armour-clads are threatened by torpedo-boats armed with Whitehead and other torpedoes of recent design. It must be remembered that not only torpedo-boats, but almost all ships of war are armed with such weapons of destruction to-day.

It is natural that the complement of these inventions was a new system of defence against the action of torpedo-boats. A new type of war vessel, the torpedo-catcher, was

evolved, specially adapted for dealing with torpedo-boats, powerfully armed, and steaming at a speed of 32 knots an hour.

Admiral Werner declares that as soon as the price of aluminium falls so low that it may be employed for the construction of ships, the sides of ships will be so powerfully protected, in consequence of the lightness of the material, that the strongest explosive shell will not penetrate them, and a battle against torpedo-boats will become mere child's play. Now the price of aluminium has lately fallen to such an extent that it is already being employed for many articles of domestic use, such as keys. If this prophecy be fulfilled the European powers will be compelled to disburse fresh millions on aluminium ships. This could have but one consequence. Invention, even now stimulated in most countries by manufacturers and their patrons, would seek to discover even more powerful explosive combinations. The last act in this rivalry it is impossible to foresee.

For the purpose of protection against mines, the more important parts of warships, the boilers and engines, are now being protected even under water by especial armour, and surrounded with layers of coal. In addition water-tight compartments have been adopted to ensure the unsinkability of the ships, and torpedo-nets are carried. The value of such defences will be proved in the future. But experiments carried on in England have tended to show that the protection of torpedo-nets is ineffective. On experiment being made to ascertain whether a torpedo-boat might pass through an obstacle constructed of strong beams, it was shown that the torpedo-boat, striking the obstacle when at a speed of 20 knots, broke it and returned to harbour undamaged.

A commission appointed by the United States Government for the purpose of considering the question of attack by and defence against torpedo-boats, came to the almost unanimous conclusion that torpedo-boats will certainly destroy an armour-clad if they escape destruction during the two minutes in the course of which the vessel attacked

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will be able to employ its quick-firing guns. But the effectiveness of defence is weakened by the fact that in all navies the number of torpedo-boats is from three to seven times greater than the number of armour-clads, and the loss of several torpedo-boats cannot be compared in gravity with the loss of a single armour-clad carrying an incomparably larger crew, and costing an incomparably greater sum.

It is true that the smallness of torpedo-boats and the insignificant quantity of stores they carry prevent them from seeking an enemy in the open sea. But these obstacles are overcome by the building of special vessels for the transport of torpedo-boats. In addition, all torpedo-boats built to-day are seagoing, develop great speed, and steam a considerable distance with their own supply of coal, while their size is being increased on all sides.

In any event, it is not reckless to predict in the near future the invention of subterranean torpedo-boats, which will carry torpedoes of such power that even aluminium armour will not avail to save the vessel attacked.

A future war on sea might be considered under the following heads: Operations on the littoral, operations against ports and merchant ships, and battles between separate ships, squadrons, and fleets. With long-range modern guns and powerful projectiles, maritime towns may be threatened with a destruction from which they will not recover for a long time. Of the smooth-bore 12-inch mortar of the old type, the greatest range was 2500 yards; the modern 12½-inch guns of the Canet system throw a shell weighing 986 pounds, and filled with 275 pounds of explosives, to a distance of 13½ miles, so that towns may now be bombarded from a considerable distance. It must be remembered that, as is shown by the practice at manœuvres, the principle that undefended towns are not to be subjected to bombardment is not acknowledged, and in a future war no town will be spared. As evidence of this the following case may be cited. On August 24, 1889, the following letter was addressed by the commander of the *Collingwood* to the Mayor of Peterhead:

By order of the Vice-Admiral commanding the 11th division of the fleet : I have to demand from your town a contribution of £150,000 sterling. I require you to deliver to the bearer of this letter a guarantee of the immediate fulfilment of this condition. I regret the necessity of demanding such a large sum from the peace-loving and industrious population of the town, but I cannot act otherwise in view of the immense contributions exacted by your warships from the prosperous city of Belfast. I must add that in case the officers who deliver this letter do not return within the course of two hours the town will be burnt, the shipping destroyed, and factories ruined.

This letter was printed in all the newspapers, and called forth no protest. On a question being raised on the subject in the House of Commons, the First Lord of the Admiralty answered evasively. It is evident then that England will not refrain from such action when convenient, and as her voice is the most important in naval matters, the other powers will certainly follow her example.

To avoid such dangers, all powers have occupied themselves with the defence of their coasts by means of fortifications, and the building of railways for the transport of artillery from one point to another as the exigencies of defence demand. But the firing from coast batteries, notwithstanding ingenious methods of measuring the distance of moving and hardly visible objects, would be only waste of powder and shell. A steamer moving with a speed of 13 miles an hour will in 30 seconds traverse 175 yards while a shot from coast artillery requires about five minutes. By skilful artillerymen this time might be shortened to from two to three minutes. On the other hand, in the bombardment of the immense spaces covered by coast towns almost every shell will find its sacrifice, and each upon explosion will cause ruin over an immense space.

The blockade of ports in a future war is also likely to have immense importance, since each of the combatants will consider as a main object the interruption of the maritime communications of the other, and the causing of all possible damage to trade by blockading his ships in ports and harbours.

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But history teaches that even in a time when sails were the only method of sailing, single vessels and even whole squadrons succeeded in escaping into the open sea. It would seem that nowadays, what with the speed of vessels, and the strength of coast defences which compel blockading ships to remain at a considerable distance, no state can rely absolutely upon closing the ports of even a weaker enemy, whose cruisers may therefore keep the sea, and injure and interrupt the trade of the stronger power.

In contrast with that which is the case on land, the field of battle at sea is in no way limited, and both sides have a free choice of movement. Here we find not a certain number of human beings, but a limited number of floating fortresses equipped with complex machinery, and armed with guns and torpedoes of almost miraculous power, cruisers which for rapidity of movement may be likened to the fabled giant with the seven-league boots, and finally torpedo-boats equipped with forces capable of sending the greatest battleship to the bottom. In open sea battle will take place only at the will of the swifter fleet. The commander will also find himself in a position different from that of a general on land. At sea the commander is first in the battle, he stands in the midst of all, he is the first object of the enemy's fire, his decision must be immediate. In the opinion of the majority of specialists, vessels which take part in great battles will issue from them damaged to such an extent, that for the rest of the period for which the war will last they need not be taken into account.

In the first half of the present century the effect of shore batteries on ships, and the results of battles between ships themselves, were not very terrible. The heavy shot discharged by smooth-bore guns carried for a very short distance, often missed its target, and the greater part of the damage it caused could be repaired by means at hand.

The adaptation of rifled guns, and of shells charged with high explosives, have entirely changed the conditions of

war. The destruction now caused by a single well-aimed shell is so great that in comparison the effect of red-hot shot is but a trifle. Modern shells will not merely penetrate vessels, causing a puncture their own diameter in size, but will destroy whole sections of the ship, annihilating everything around them. Yet on modern vessels are found machinery of every kind, marine engines, dynamo-electric engines, pumping, steering, hauling, and ventilating apparatus. Every gun, every steam pinnace has its own complex machinery. Add to this miles of electric wire, and a wilderness of constructions of every kind concentrated in the machinery departments, in which men by artificial light, and in artificially induced atmosphere, in isolated groups, and cut off from their commanders, must with full control of their business, execute immediately and coolly orders proceeding from an unseen leader by telegraph. Such, in brief, is the modern man-of-war.

To give some idea of the *rôle* played by machinery in modern ships we may cite a comparison made by Admiral Makarof between a wooden frigate of the old type and the modern cruiser *Rurik* : "The engines and boilers of the cruiser *Rurik* occupy 192 feet length in the widest part of the ship. In order to understand what this means we may say that if we were to take out of the ship the engines and boilers, also the coal bunkers, and fill the vacant space with water, a frigate of the old type might easily be moored inside, with all its equipment and all its guns. Around the frigate there would be sufficient space to steer a pinnace. Within this space of 192 feet all is compressed to a seemingly impossible extent. . . . The engineer must be an acrobat, and the stoker, who with forced draught must make the boiler give twice the steam pressure that corresponds to its dimensions, must in endurance and energy give way in little to Satan himself."

With growing complexity of the mechanism the need for intelligence has also grown. In former times when wind was the only motive power of vessels the result of battles depended much from skilful seamanship, and in

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the end of ends was decided by boarding. Steam power has entirely changed these conditions. The course of the battle will be determined by steam alone, whatever may be the direction of the wind, and it will be decided by torpedoes, by artillery, or by the ram. In the time of sailing ships a movement once determined upon could not be concealed; with steam it need not be revealed until the last movement. Thus the need for leadership and decision has grown to a remarkable degree. The German authority Henning justly remarks: "As far as technique is concerned, it may be said that everywhere, in England, France, Germany, Russia, and Italy, it will give similar results. Here the whole question lies in the training and firmness of the commander and of the crew, and afterwards in the successful employment of technical factors. Of course he will have an advantage who commands a crew formed of born sailors, but in battle this advantage may be counterbalanced by individual qualities of command."

After making a study of the conclusions which are drawn from the battle of Lissa, the wars of 1870 and 1877, the Chilian war of 1879, the Tonkin Expedition of 1885, the naval operations in the Chilian war of 1891, and, finally, the war between China and Japan, and having in view the opinions of the best authorities, such as White, Brassey, and Werner, it is impossible not to conclude that a battle between fleets equal in speed and armament will lead very quickly to the destruction by shell-fire and conflagration of the upper decks in which are concentrated the chief directing elements, while a considerable part of the crew will be killed, and in the number every officer who successively occupies the post of commander. In one word, in the first battle a considerable proportion of the ships will be destroyed, and the remainder will be forced to go into port to refit. Therefore in war the strongest will prove to be the nation which possesses the greatest number of arsenals and ready stores of ammunition and coal at points selected in times of peace; and in addition to that a fleet in reserve, even a fleet of old type, but equipped with modern artillery; with such a

fleet it will be possible to strike deadly blows at the enemy when the fleets of the first line shall have been forced to leave the seas in consequence of damage sustained in battle.

In all probability future naval battles will present this difference from those of the past—even from recent battles—that solitary vessels will not take part, but whole squadrons consisting, as armies, of their own sort of cavalry, artillery, and infantry, that is, their swift cruisers, their battleships, and, finally, of their torpedo-boats and torpedo-catchers. With this the element of accident will play such an important *rôle* that naval battles will almost resemble a game of dice in which the stakes will be millions of money and thousands of lives.

It is certain that all that is not defended by armour will be swept from the decks by the shell-fire of quick-firing guns, and it remains an open question if even that portion of the crew which is in protected positions will be able to stand the concussion produced by the explosion of shells. Attention must be called to the ease with which shells produce conflagrations of decks, masts, bridges and everything inflammable. All that is near the region of explosion of a shell will be totally destroyed, a thousand steel fragments will fly about with inconceivable rapidity, penetrating decks and corridors. Some of the shells which fall in an ironclad will immediately make a part of its guns useless, and the employment of the larger guns will be impeded, since the turning of the turrets will be impeded by torn plates. Shells containing heavy charges will cause immense destruction. If a shell loaded with 22 pounds of melinite were to fall between the two decks of an ironclad its explosion would destroy the balks supporting the deck, rend the iron sheets, pierce the deck, stretch the electric wires until they broke, damage the steam pipes and boilers—in one word, disable all the vital organs of the ship for a space of several yards around the region of explosion, and in addition produce suffocating fumes which would prevent approach for a quarter of an hour, however perfect might be the ventilation.

It needs no evidence to prove that it is extremely

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doubtful that any one state can obtain a decided preponderance above the others in the quality of its ships or their armament. In the present state of technical science every improvement adopted by one power is immediately adopted by all the others. The number of vessels of an obsolete type is great, but these less effective ships are divided among the different powers in proportion. The fate of future battles will therefore depend primarily on accidents which cannot be foreseen, and secondly on the possession at a given moment of preponderating strength. But in this respect we find that in spite of all efforts the relative strength of fleets has changed but little, and the comparison made by Admiral Werner therefore seems entirely true. "A naval battle," he says, "if both adversaries are determined and energetic, will resemble a conflict between two stags which in a moment of fury rush upon one another, entangling their antlers, and in the end of ends destroying one another. Or if the enemies are less determined a naval battle will resemble a contest of athletes, the combatants moving backwards and forwards in serpentine lines; both will keep up fire from a great distance until neither has enough ammunition left to strike a decisive blow."

To cruisers and torpedo-boats will be allotted a duty not less ferocious—a duty which, in the Middle Ages, was fulfilled by pirates and privateers—to pursue merchant ships, fall on them by night and sink them, with passengers, crews and cargoes, with the object of cutting the communications and paralysing the trade of the enemy. The following passage, which we find in "Les Guerres Navales de Demain," is an interesting illustration of this: "A war on commerce will have its regulations, precise, constant, and unconditional; the weak will be attacked without mercy, the strong will be evaded by flight without any false shame. Our torpedo-boats and cruisers as soon as they discover an English squadron from afar, or even a single battleship, it may be not exceeding them in fighting strength, but capable of offering even slight opposition, will be bound to disappear."

From such passages, and from the declarations of unquestioned authorities, it is impossible not to conclude that the effect of future naval wars on future trade will be incomparably more disastrous than before. A future war on sea will also draw after itself economic and political consequences quite different from those of the past, when every state found its needs supplied within the limits of its own dominions. The general use of shells loaded with explosives which may be thrown a distance of some miles, shells, one of which falling into a town or settled locality may cause the most terrible destruction ; and the speed with which vessels may be moved from one point of a coast to another, independently of weather and wind, must affect the minds of peoples, and even give rise to agitations. And such agitations, in view of the present general socialistic tendencies, may not be limited to temporary disorder. On preparations for naval war immense sums are yearly expended by the powers, but shipbuilding so constantly and so rapidly advances towards perfection, that a large proportion of modern fleets is obsolete, and incapable of meeting in battle vessels of the newer types, some being unfit for employment even after the destruction of the latter.

All this was more or less clearly foreseen ten years ago on the appearance of smokeless powder. And in the present time, in view of the speed attained by cruisers armed with strong artillery, and also by torpedo-boats of the latest type ; in view of the improvements in the propulsion of torpedoes, and in view of the progress made in the building of submarine boats, it may be affirmed that even vessels of the latest types, however they may be divided among the different nations, cannot guarantee the attainment of the ends of war.

Meantime, for the improvement and increase of fleets new credits are required every day. We may well inquire what degree the discontent of peoples may attain when they learn that even the newest types of ships and the last inventions in artillery have been adopted everywhere, while requirements still continue to grow. In view of

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those elements which in Western Europe to-day contend with all political and social order, even more absurd appears the rivalry of states in the increase of their fleets, while the relation of fighting force remains the same, and immense sums are yearly squandered which might have been devoted to the satisfaction of social needs.

A comparison of the growth of expenditure on armies and fleets is presented by the following table (counting the rouble as equal to three shillings) :

		EXPENDITURE.				
		On Armies.		On Fleets.		
		Millions of	£	Millions of	£	
		Roubles.		Roubles.		
1874	.	615.4	92,325,000	...	158.2	23,730,000
1884	.	688.1	103,215,000	...	218.6	32,790,000
1891	.	885.1	132,765,000	...	247.2	37,080,000
1896	.	893.6	134,040,000	...	299.6	44,940,000

To express more clearly the comparative growth of outlay on armed forces, we take the outlay of 1874 at 100, and find the following percentage increase :

		Armies.		Fleets.	
1874	.	.	100	...	100
1884	.	.	112	...	138
1891	.	.	144	...	156
1896	.	.	145	...	189

The comparison which we have made as to the naval resources of the different states shows that these millions can have no practical result, even if we admit that war is as unavoidable in the future as it has been in the past.

Calculations made by us show that England alone in a prolonged war could obtain the mastery of the sea, forcing the other naval powers to give way everywhere. But on the other hand, the interruption of communications at sea would cause the English such great losses as to eliminate the possibility of a prolonged war, even although they were absolutely certain of victory. The cessation of the import of provisions would not allow of England continuing a prolonged war. Of wheat, barley, and rye England lacks supplies for 274 days and of oats for 76 days in the year.

Even if we agree with the baseless opinion of optimists and assume that the transport of supplies to England might be carried on under convoy, still we must bear in mind the terrible rise in prices in consequence of the risk. And side by side with this rise in prices would proceed the interruption of industry.

Thus, in continuing to increase their fleets and to perfect their armaments at immense cost the European powers are striving at aims undefined and unattainable. But the financial and social difficulties which yearly increase may result in such dangers that governments must be compelled after immense sacrifices to do what it would be wiser to do to-day, namely, to abandon a fruitless competition.

Such is a brief picture of what Europe may expect from a future war. But over and above the direct sacrifices and material losses, by slaughter, fire, hunger, and disease, a war will cause to humanity a great moral evil in consequence of the peculiar forms which a struggle on sea will assume and of the examples of savagery which it will present at a moment when the civil order will be threatened by new theories of social revolution.

What wearisome and ungrateful labour will be needed to repair the losses, to cure the wounds which a war of a single year will cause! How many flourishing countries will be turned into wildernesses and rich cities into ruins! How many tears will be shed, how many will be left in beggary! How long will it be before the voices of the best men, after such a terrible example, will preach to humanity a higher principle than "might is right"?