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THE BRITISH BATTLE FLEET

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THE BRITISH BATTLE FLEET

ITS INCEPTION AND GROWTH THROUGHOUT THE CENTURIES TO THE PRESENT DAY

BY

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WITH ILLUSTRATIONS IN COLOUR
FROM ORIGINAL WATER-COLOUR DRAWINGS BY

W. L. WYLLIE, R.A.

AND NUMEROUS PLANS AND PHOTOGRAPHS.

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THE BRITISH BATTLE FLEET.

I.

THE BARNABY ERA.

THE characteristic *motif* of the Barnaby designs has been described as a " maximum of offensive power and the minimum of defence." This is not altogether correct ; though as a generalization it is no very great exaggeration. In every Barnaby design proper, offence was the first thing sought for, but defence as then understood was by no means overlooked as to-day it appears to have been.

The bed rock " Reed idea " was to produce a ship which could attack and destroy the enemy without much risk of being damaged in doing so. The " Barnaby idea " was that " the best defensive is a strong offensive" ; and a strict subordination of defence to what might best serve the attack on the same displacement.

The first big armoured ship to be laid down at all on Barnaby principles, the *Inflexible,* was built under somewhat peculiar circumstances. In the year 1871 a Committee was appointed. One of its findings was as follows :—

" As powerful armament, thick armour, speed, and light draught cannot be combined in one ship, although all are needed for the defence of the country ; there is no alternative but to give the preponderance to each in its turn amongst different classes of ships which shall mutually supplement one another."*

* Most of the criticism past and present of the Barnaby era is rendered worthless by an ignoring of this report.

Amongst the Committee's suggestions had been the abolition of the complete belt, and its concentration amidships. This recommendation was mainly intended to refer to cruising ships rather than to ships definitely intended for the line of battle; but the idea soon spread.

These suggestions had already been embodied in a modified form in the *Shannon*, of which particulars will be found later on. The *Shannon*, however, was frankly a "belted cruiser," and no idea had then been entertained of adapting a similar system for heavy armoured ships.

In the year 1874, however, it transpired that the Italians were evolving an entirely new type of battleship, the *Duilio* and *Dandolo*, and adopting a central box system. By this means they were able to protect the citadel with 22-inch armour and mount four 100-ton guns in two turrets *en échelon*, so that all four could bear ahead and astern as well as on either broadside. The seriousness of the situation was increased by the fact that in most of the tactical ideas of the day, end-on approach figured largely.*

Compared with these Italian designs, the most powerful British ironclad of those days, the *Dreadnought*, with a belt of only 14-inch to 11-inch armour, and bearing but two of her four 38-ton guns end-on, cut a sorry figure.

It was deemed essential to build a "reply." The largest gun actually available at the time was, however, the 81-ton M.L.; so this was adopted for the new ship. The *Inflexible* being frankly an adoption of Italian ideas, she can hardly be described as the design of any one man; Sir N. Barnaby having been tied down to an extent with

* This is instanced by the increasing ahead fire given to the broadside ironclads.

Photo] [*Un.*

THE *INFLEXIBLE*, AS ORIGINALLY COMPLETED, 1881.

which (from his subsequent writings) he did not, it would appear, altogether agree. A smaller central citadel than that of the Italian ships was adopted, but the thickness was carried to 24-inch, the thickest armour ever introduced into an ironclad either before or since. The bulkheads were 20-in. The freeboard of the central redoubt was 10ft. Round about it, fore and aft, on an armoured raft-body were built a bow and stern, with superstructures curtailed to the centre line sufficiently to allow of unimpeded end-on fire from the big guns, which, like those of the Italians, were placed in échelonned turrets.

With a view to satisfying the "masted turret-ship" ideal, an absurd brig rig was fitted to the *Inflexible.* With this it was possible for the ship to drift before the wind, haystack-fashion, but the rig was so much of the "placebo" order that it was designed to be taken down and thrown overboard in case of action! At a later date it was removed altogether and a military rig substituted.

The *Inflexible* was crammed with novelties. Like the *Devastation* she was the "*Dreadnought*" of her time. Chief among her innovations were the adoption of submerged torpedo tubes (of which she had two), the mounting of Nordenfeldts as a definite anti-torpedo-boat armament, and an ingenious anti-rolling arrangement, whereby water was admitted amidships to counteract the roll. This was very partially successful; but in 1910 the idea reappeared in a slightly altered form and is now used in certain big Atlantic liners.

An ingenious feature of the *Inflexible* concerned the big guns. In the *Devastation* and *Dreadnought* types these could be run in and loaded inside the turret. With the much larger guns of the *Inflexible* this was impossible, without a very considerable increase of the size of the turrets. Outside loading without protection was recognised as unsuitable and practically impossible. A special glacis was, therefore, designed, which admitted of outside loading under cover, and at the same time ensured that, in the event of premature discharge, the projectile would emerge above the waterline and not below it.

This device is of special interest as the "last word" of those muzzle-loading guns to which the British Navy adhered so long as it possibly could. Had it been thought of earlier, the British Navy might perhaps have adhered to muzzle-loaders even longer than it did. As things were, the *Inflexible* device came too late to stay the tide which had already begun to set strongly in the breechloader direction.

Details of the *Inflexible* were :—

Displacement—11,880 tons.

Length (between perpendiculars)—320ft.

Beam—75ft.

Maximum Draught—26⅓ft.

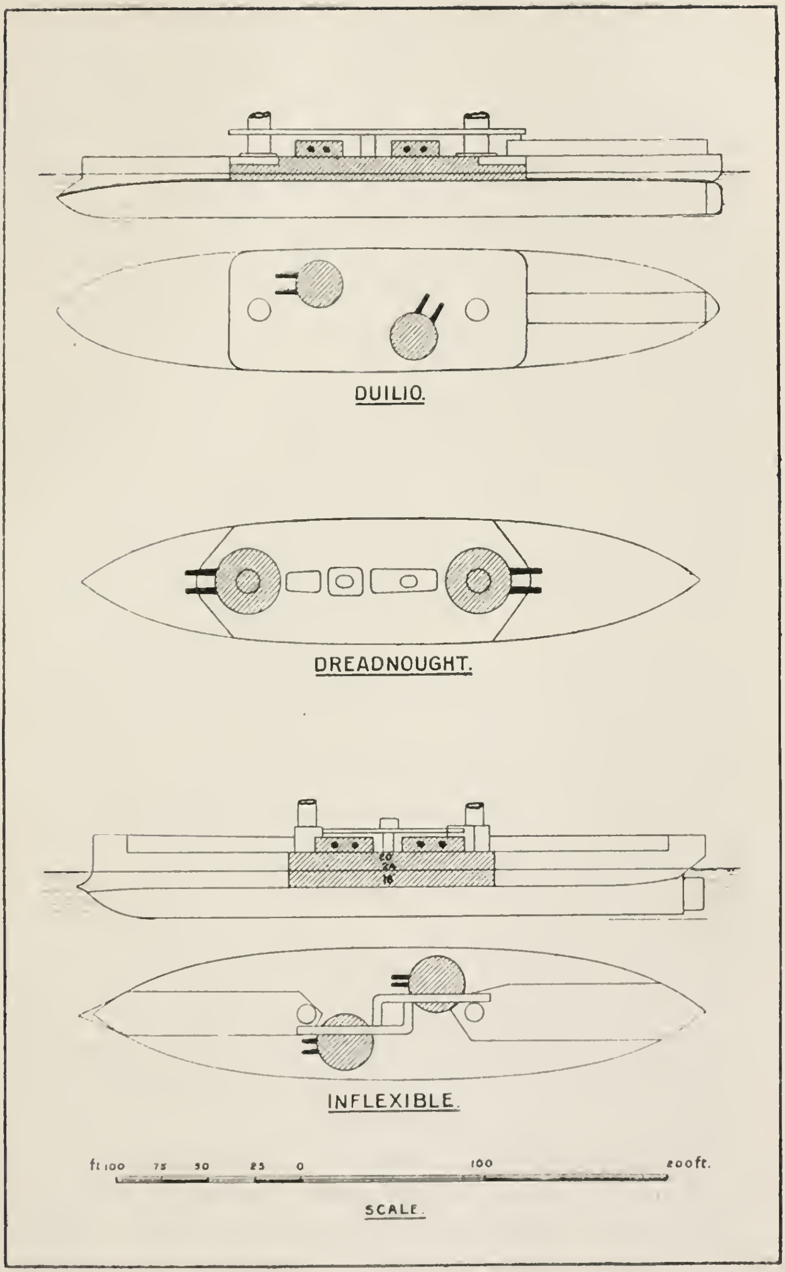
Armour—Belt amidships 24-16-inch, beyond that a protective deck only; 22-14-inch bulkhead, all iron; and 17-inch compound armour turrets.

Armaments—Four 81-ton guns (to which eight 4-inch breechloaders were added later on). Two submerged tubes and two above-water launching appliances for torpedoes.

Horse-power—8,010 (I.H.P.).

Speed—13.8 knots.

Coal—1,300 tons= nominal 10-knot radius of 5,200 miles.



EARLY TURRET-SHIPS OF THE BARNABY ERA

Built at Portsmouth Dockyard. Engined by Elder. Completed 1881.

On completion she was sent to the Mediterranean, with Captain Fisher (afterwards Admiral of the Fleet, Lord Fisher) in command of her. He was the chief gunnery officer of those days and the founder of the torpedo school. At the time it was put on record that, asked by a Press interviewer what he would do if the fortunes of war brought it about that he had to encounter a similar "last word" in naval construction, he replied that he would keep away from her till nightfall, and then send in the, then, novel second-class torpedo-boats which the *Inflexible* carried, to settle the foe. Over which statement the historian of fifty years hence may yet place Lord Fisher among the prophets. To-day, some thirty years later, similar ideas obtain, but have got no further. Fifty years hence——?

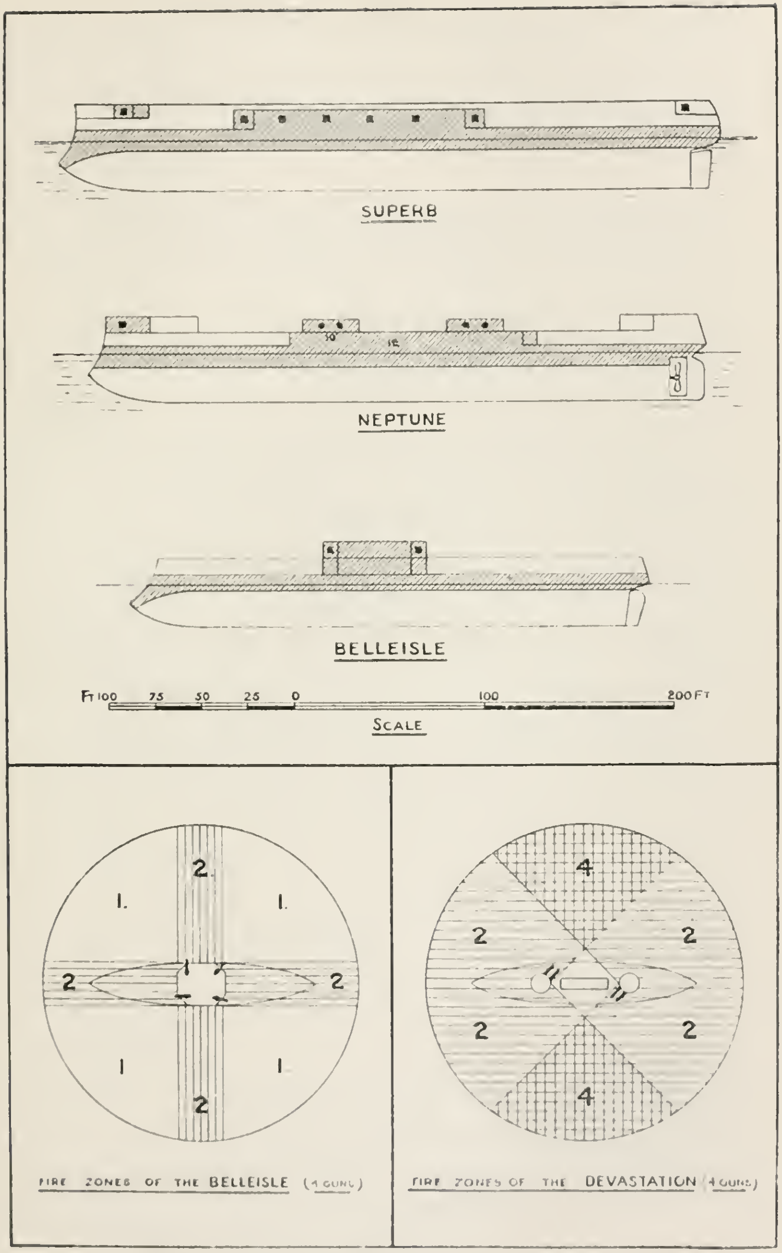
In 1882 the *Inflexible* was the central figure at the bombardment of Alexandria. The damage she did was infinitesimal compared to the ideas which the public had formed of her. Far more actual mischief was done by Lord Charles Beresford in a trivial gunboat, the *Condor*, which steered into close range of the hostile guns and knocked them over. At the time this was regarded as an act of spectacular heroism; but the historian of the future is far more likely to discover in it (as in the Fisher torpedo-boats) something closely akin to the reasoning behind Nelson when he destroyed the French fleet at the Nile or charged into them at Trafalgar. The commonplace expression, "sizing up the other man," and acting accordingly, is the secret. In peace time we are all too apt to assess hostile weapons at their theoretical potentiality. The victors in war are those who gauge correctly the handling ability of the man behind the weapon and—act accordingly.

About the years 1877-78, towards the close of the Turco-Russian War, an Anglo-Russian war seemed probable, and four foreign ships building in England were purchased for the British Navy.

These were the Brazilian *Independencia*, an improved *Monarch*, designed by Sir E. J. Reed, which went into the British service as the *Neptune*. Save that she carried 38-ton guns instead of 25-ton, she reproduced the *Monarch* idea almost exactly. After certain vicissitudes she entered the British service, and eventually was fitted with a couple of military masts. The points of special interest about her were that (1) owing to some error her funnels were put in sideways instead of as designed; and (2) in service in any bad weather the sea regularly washed out her wardroom ; (3) she was the first ship of the British Navy to carry a bath-room. As an effective warship she never figured to any large extent.

The other three purchased ships had been destined for the Turkish Navy ; and all three turned out worse than the *Neptune*. The *Hamidieh*, re-christened *Superb*, more or less duplicated the *Hercules*. She took part in the bombardment of Alexandria a little later, and it was there discovered that her guns could not train at all well in comparison with contemporary British naval ships.

Of the fighting value of the other two ships, *Pakyi-Shereef* and *Boordyi-Zaffir*, which became the *Belleisle* and *Orion*, the least said the better. They turned out to be nothing but improvements on a type of "coast defender," already obsolete, diminutives of the original Reed broadside idea applied to a *Hotspur* type hull. In place of the single 25-ton gun of the *Hotspur*, they carried



FOREIGN SHIPS PURCHASED FOR THE NAVY IN 1877–78.

four similar guns—the old 12-inch 25-ton M.L. These guns were carried in a central raised battery, from which, as in the *Hotspur*, one gun could always bear, and from which two bearing on an exact and unlikely broadside might be looked for.

No useful service was ever performed by these ships. The *Belleisle* ended her service as a target, the *Orion* as a hulk. They proved conclusively that the central battery idea was obsolete and so far probably did good service. In the past Sir E. J. Reed had argued, and for that matter proved, that for a given weight of armour and armament eight guns, four on either broadside, could be mounted with equal protection and economy of weight as against two pairs of guns in turrets.* The *Belleisles* gave the lie to this idea, however, when it came to be applied to half the number of guns. The step from that to the same thing with more guns was made easy, and the turret idea assured, out of the *Belleisle* type. To the *Belleisle* and *Orion* more than any other ships may be traced the first real appreciation of "angles in between" —the demonstration that "right ahead" or "right on the broadside" were ideal positions which no enemy would willingly assume.

The *Devastation* and her sisters had, of course, anticipated this idea; but to the *Belleisle*, at most fighting angles only able to bring a quarter of her battery into action, may be traced most modern developments in gun disposition.

Contemporaneous with the special Barnaby ships, reference may be made to the entirely nondescript *Téméraire*. She may be described as an absolute hybrid —partly Reed, partly Barnaby, partly gun inventors of the era, and partly nothing in particular.

* *Our Ironclad Ships.*

Details of this ship are :—

Displacement—8,540 tons.

Length (between perpendiculars)—285ft.

Beam—62ft.

Draught—27¼ft.

Armament—Four 25-ton 11-inch M.L. (two in barbettes), four 18-ton M.L.—two above water torpedo tubes.

Armour (iron)—Complete 11-8in. belt. Bulkheads 8-5in. Barbettes 10-8in. Battery 10-8in.

Horse-power—7,520=14.5 knots.

Coal—620 tons=2,680 miles at economical speed (nominal).

The *Téméraire* was unique in the world's navies in that two of her 25-ton guns were carried—one forward, one aft—on special Moncrieff mountings, an adaption for naval purposes of the "disappearing gun," invented for forts of that era. The gun, loaded under cover, was raised to fire by hydraulic mechanism, and then recoiled to the loading position. The ship was otherwise essentially of the Reed box-battery type; the other two 25-ton guns being in a central main-deck battery, and capable of a good deal of ahead fire. The other big guns (18 tons) were cut off from the 25-ton by an armoured bulkhead, and merely had the ordinary broadside training.

Like the *Inflexible*, the *Téméraire* had a heavy brig rig. Towards the end of her active service career this was replaced by a military rig; but all her active work was done as a brig. She was built at Chatham Dockyard, engined by Humphrys, and completed for sea in 1877.

In 1882 she was at the bombardment of Alexandria, and there did more execution than any other ship. Her subsequent career was uneventful, and in her own way she was a "monstrosity" as much as the *Polyphemus* was. She is generally understood to have been a "naval officers' ideal" ship, rather than the regular production of the Chief Constructor. Whether this be true is, at least, doubtful. Certainly she may equally well be regarded as the forlorn hope of those who looked to see the general principles of the central battery system adapted to suit the new ideas as to ironclads. French ideas* also had probably something to do with her peculiar design.

The idea embodied in the *Inflexible* was so pleasing to the authorities of that period that she was duplicated in two smaller vessels of the same type, the *Ajax* and *Agamemnon*, though the precise purpose for which these vessels were built is difficult to fathom. They were in every way inferior to the *Inflexible*, and mainly of interest as indicating the definite abandonment of the idea of the masted battleship, and they were also the last ships to mount muzzle-loading guns :—

Particulars of these ships were :—

Displacement—8,660 tons.
Length (between perpendiculars)—280ft.
Beam—66ft.
Draught (mean)—24ft.
Guns—Four 38-ton M.L., two 6-inch 81-cwt. B.L.
Horse-power—5,440.
Speed—13.25 knots.

These were followed by the *Colossus* and *Edinburgh*, which were laid down in 1879. In these ships the 12-inch breechloader was adopted, and an attempt at what was then a very considerable speed was made.

* In this connection see *Imperieuse* and *Warspite* later on.

An auxiliary armament made its first really definite appearance, five 6-inch guns being mounted on the superstructure.

Particulars of these ships were :—

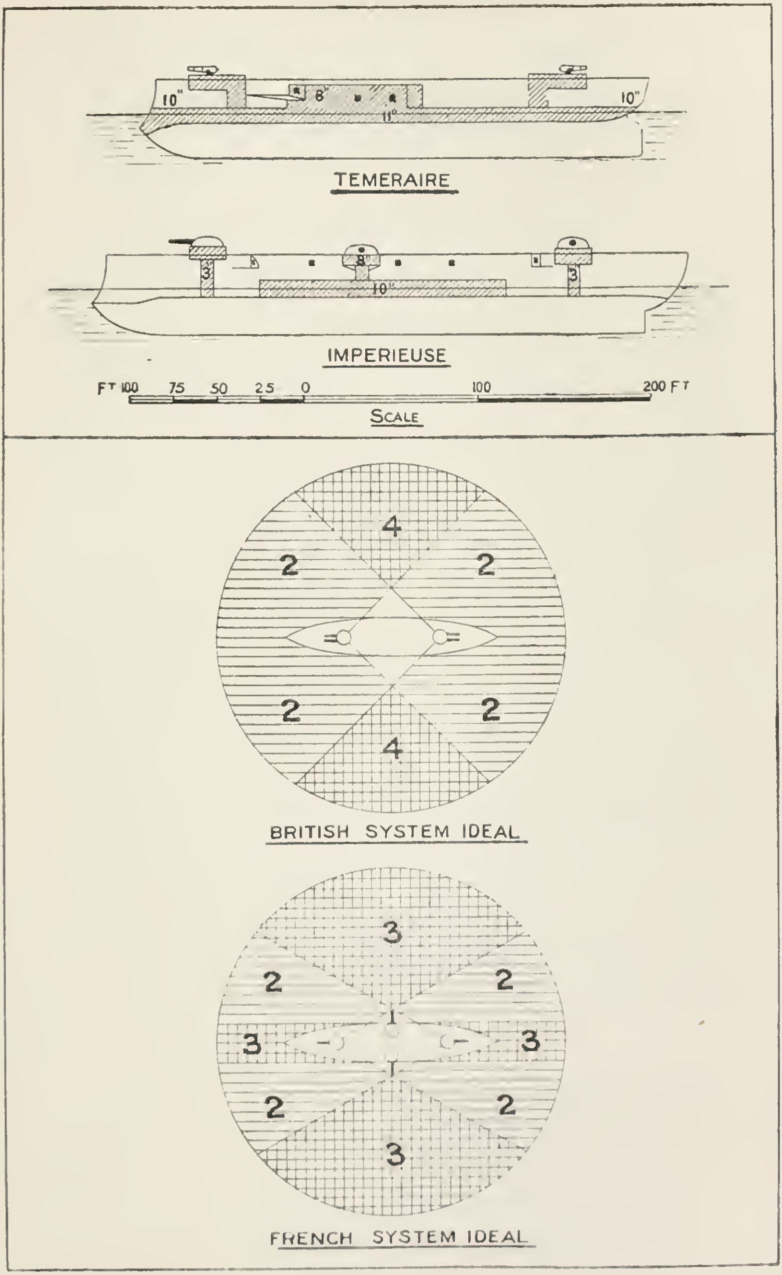
Displacement—9,420 tons.
Length (between perpendiculars)—325ft.
Beam—68ft.
Draught (mean)—26ft. 3ins.
Guns—Four 45-ton B.L.R., five 6-inch, 89-cwt. do.
Horse-power—7,500.
Speed—15.50 knots.

At and about the same time considerable interest was being taken in rams. This resulted in the laying down of the *Conqueror*, a species of improved *Rupert*, and a type of ship destined to be enlarged upon in the future.

Particulars of the *Conqueror* were :—

Displacement—6,200 tons.
Length—270ft.
Beam—58ft.
Draught—24ft.
Armament—Two 45-ton B.L.R., four 6-inch 89-cwt. do., six 14-inch torpedo tubes (above water).
Horse-power—(maximum) 6,000.
Speed—15.5 knots.
Coal—650 tons.

The *Conqueror* was launched in September, 1881. Some three years later a sister, the *Hero*, was laid down, and launched towards the end of 1885. She differed from the *Conqueror* only in that all four of her 6-inch guns were mounted on the superstructure, whereas the *Conqueror* carried two of them on the main deck inside the superstructure.



BARNABY BARBETTE SHIPS

Although developed from the *Rupert*, the *Conqueror* differed a good deal in appearance, on account of the whole of the after part of the ship being one huge superstructure. In her, the superstructure, as a very definite feature instead of a mere accessory, may be said to have made its first appearance, to remain as a factor of growing importance for many years.

Contemporaneously with these ships two entirely different types made their appearance. One of these was the "torpedo ram" *Polyphemus*, an absolutely unique vessel, the outcome (though not so designed) of the influence of the torpedo. The ship was never duplicated, and never performed much service, but it would be rash to assert that the future may not see something like her re-appear. She was first projected as a "ram" pure and simple, so long ago as 1873, and designed by Barnaby to suit the specifications of certain naval officers as embodying their ideals of the warship of the future. This is the generally accepted theory, though Sir N. Barnaby* has made public a somewhat different view of the matter, and according to him, Admiral Sir George Sartorius, the naval officer principally concerned, lost his interest in the *Polyphemus* when it was decided to give her an armament of torpedo tubes and some quick-firers against torpedo attack. So far as can be gauged, the torpedo tubes were likewise a naval innovation with which Sir N. Barnaby was also not much in sympathy. At any rate, he has put on record the view* that :—

> "The introduction of torpedoes made the ship far more costly than she need have been, and it is possible that the type would have been continued and improved had the simplicity of the ram been adhered to."

The *Polyphemus* performed little useful service ; her

* *Naval Developments of the Century*, by Sir N. Barnaby, pp. 163-164.

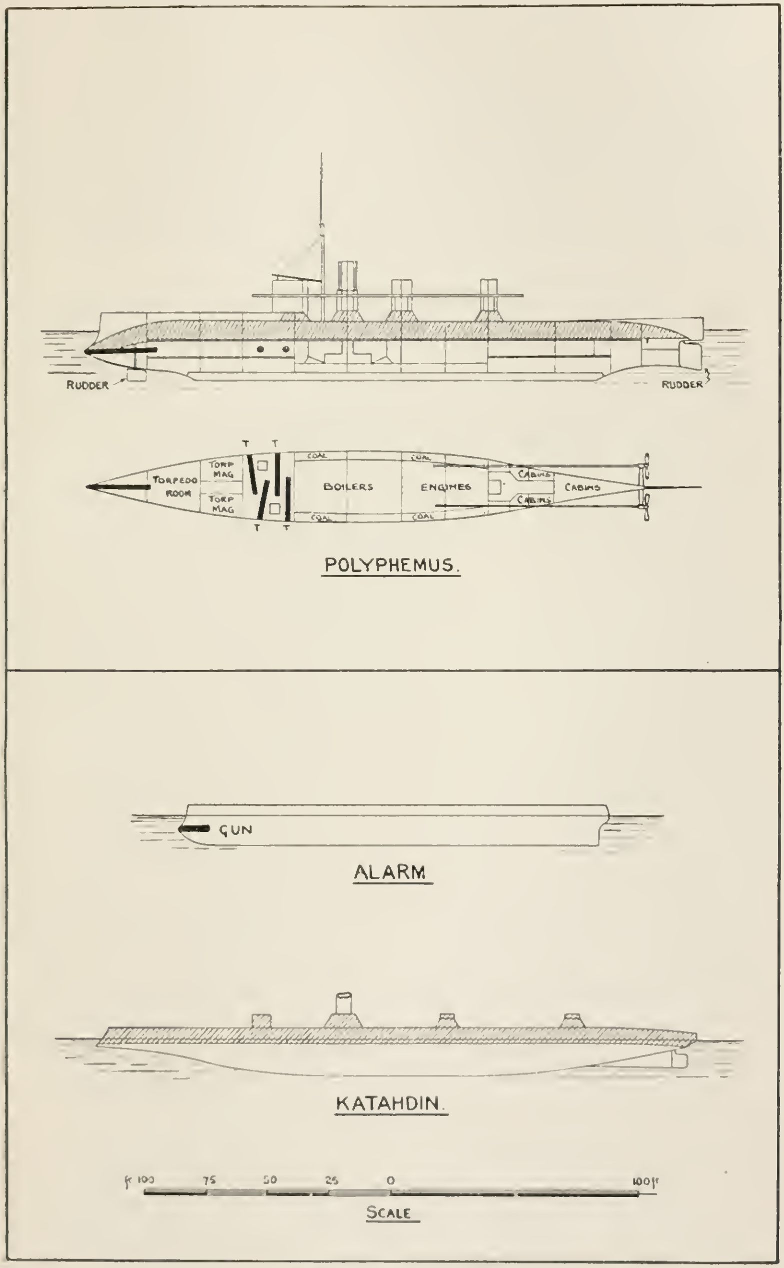
life on the Navy List was short; and she is always spoken of as a "failure." Officers who served in her were, however, invariably enthusiastic about her, and had war occurred during the time that she was in existence there is no telling what she might have accomplished or how profoundly she might have affected naval construction.

In essence the *Polyphemus* was a semi-submerged craft, those parts of her which were above water being merely a light superstructure for the accommodation of her crew in peace time.

She was of 2,640 tons displacement, length 240ft. between perpendiculars, beam 40ft., and a normal mean draught of 20ft. In form she was cigar-shaped, plated with 3-inch armour on the upper part of her curved sides. With 5,520 I.H.P. she had the then very high speed of 17.8 knots. She carried 300 tons of coal, sufficient for a nominal radius of 3,400 miles at economical speed.

Her principal feature, however, was the fitting of five submerged tubes, one in the bow the others on the broadside. For repelling a torpedo attack she carried six 6-pounders and a couple of machine guns.

It is here of interest to relate that some years later the U.S. Navy created a species of *Polyphemus* imitation in the "ram" *Katahdin*. To a certain extent they had anticipated her likewise in the *Alarm*, 720 tons, launched in 1873, which carried a 15-inch smooth-bore gun *under water* in her ram, and the *Intrepid* (launched 1873), of 1,123 tons, of which no details ever transpired, and it may be said that she was "strangled at birth." But the *Polyphemus's* ancestry is undoubtedly American. The *Katahdin* (first produced as the "ram" *Ammen*) was not launched till 1893. She was of 2,050 tons and seventeen knots, and having no torpedo tubes, being a "ram"



SOME FAMOUS RAMS.

pure and simple, exactly reproduced the Sartorious-Barnaby idea. She soon disappeared from the U.S. Navy List, and she never did anything. She doubled the armour of the *Polyphemus,* whilst lacking her torpedo armament. Since then, the idea has found expression in three small U.S. "semi-submerged" boats, with the torpedo as their main armament; but these three boats never got beyond the "designed" stage. No other nation ever exhibited the least interest in the *Polyphemus* idea.

Reference has already been made to the *Shannon,* which was the first armoured cruiser of the British Navy. She was launched towards the end of 1875 and completed two years later. In substance she was a development of the idea which first found expression in the *Inconstant,* heavy armament being preferred to the protection of the guns. A narrow belt of armour with a maximum thickness of 9-ins. protected three-quarters of the water-line. This belt commenced at the stern and ended in a bulkhead some 70ft. from the bow. Forward of this bulkhead was an under-water protective deck, and a certain amount of armour was concentrated on the ram under water. The bulkhead, which was from 9in. to 8in. thick, rose to the upper deck, and afforded protection to a couple of 18-ton muzzle-loaders, capable of right-ahead fire. The remainder of her armament consisted of seven 12½ton guns, and was entirely unprotected.

Other details of the ship are as follows:—

Displacement—5,390 tons.
Length—260ft.
Beam—54ft.
Draught—23ft. 4in.

Horse-power—3,370.
Speed—12.35 knots.
Coal carried—580 tons= nominal economical radius of 2,260 miles.

The speed of the *Shannon* was so low, even in those days, that it is a little difficult to surmise for what purpose she was designed, especially as this design was more or less contemporary with the re-designing of the *Dreadnought*.* It found favour, however, since she was almost immediately followed by two larger replicas, the *Nelson* and the *Northampton*, details of which were :—

Displacement—7,630 tons.
Length (between perpendiculars)—280ft.
Beam—60ft.
Draught (maximum)—26ft. 6in.
Armour—Belt amidships, 9in. to 6in., compound: bulkhead ditto. Armour deck only, at ends.
Main Armament—Four 18-ton M.L.R., eight 12-ton M.L.R., two above-water 14-inch torpedo tubes.
Horse-power—6,640.
Speed—14.41 knots.
Coal carried—1,150 tons=nominal radius of 3,850 miles.

These ships differed from the *Shannon* in that the armour belt was confined to a waterline strip amidships, while the after guns were also protected by a bulkhead. The most curious, and to modern ideas, eccentric feature of these ships, was that they were fitted with triangular rams, which, " for the sake of safety," could be removed in peace time and merely put on for war purposes ! As a matter of fact, the ships always carried their rams without rendering themselves dangerous to anybody.

* Re-designed to give extra protection.

On the other hand, shortly after construction, the *Northampton* was run into by a small trading schooner, which cut her down to the water's edge. The ships, therefore, started with an unfavourable reputation, which the *Northampton* followed up by a total inability to make even her moderate designed speed. The *Nelson*, on the other hand, proved herself a comparatively good steamer, so much so that at a later date she was to a certain extent modernised. Both ships were originally heavily masted, the idea being to perform most of their peace service when convenient under sail. The *Nelson* sailed moderately well, but the *Northampton* very badly. It was possibly with some view to remedying this that some years later, when it was decided that the *Imperieuse*, originally built as a brig, should be given a military rig, her lofty iron fore and mainmast were taken out of her and substituted for the two equivalent masts in the *Northampton*. The change, however, was not satisfactory, as thereafter she sailed if anything worse than ever.

At and about this year protected cruisers made their first appearance in the *Comus* class. Of these altogether eleven were built, the best known of these being the *Calliope*, which in the early nineties became famous through steaming out of Samoa Roads in the teeth of a hurricane, which utterly destroyed every foreign vessel anchored there at the same time. The *Comus* class consisted of the *Calliope*, *Calypso*, *Canada*, *Carysfort*, *Champion*, *Cleopatra*, *Comus*, *Conquest*, *Constance*, *Cordelia*, and *Curacoa*. They averaged 2,380 tons displacement, though the first mentioned, which were the last to be built, were slightly larger. The original armament consisted of two 6-ton muzzle-loaders and twelve 64-pounders. This was afterwards varied by the substitution of breechloaders. The ships generally had a speed of about thirteen knots, and were completed between the years 1877, for the earliest, and 1884 for the latest. They had a 1½-inch protective deck for the engines amidships. These ships, which were generally officially known as the "C" class cruiser, were undoubtedly diminutives of the *Shannon*, or, at any rate, inspired by a similar idea.

Besides growing downwards the idea also grew upwards, and resulted in the building of six ships of the "Admiral" class, of which the first was the *Collingwood.* These, which were the apotheosis of the Barnaby idea, represented an absolute revolution in naval construction, so far as big ships were concerned.

The "Admirals" were not all identical, as they formed four different groups in the matter of displacement and three in armament. In all, however, the integral idea was the same. Amidships was a narrow belt, 150ft. long by 7½ft. wide, which sufficed to protect engines, boilers, and communication tubes of the barbettes. This belt varied in thickness from 18ins. to 8ins. of compound armour. The ends of the belt were closed up by 16-inch bulkheads. Forward and aft was merely a curved protective deck; there was also a flat protective deck on top of the armour belt. The ships were of low freeboard, forward and aft, but had a large superstructure built up amidships. At either end of the superstructure, with their bases unprotected by armour except for the communication tubes already referred to, were many-sided barbettes with plates set at an angle of about forty-five degrees. These barbettes were about 11½ins. thick, and carried each a couple of the heaviest

Name.	*Collingwood.*	*Rodney, Howe.*	*Anson, Camperdown.*	*Benbow.*
Displacement, tons ..	9,500	10,300	10,600	10,600
Length (*p.p.*) ft.	325	325	330	330
Beam, ft.	68	68	68½	68½
Draught (*mean*) ft.	26¾	27¼	26¾	27¼
H.P.	9,500	11,500	11,500	11,500
Nominal Speed, knots	16.5	16.7	17.2	17.5
Armament	4-12in., 6-6in.	4-13.5, 6-6in.	4-13.5, 6-6 in.	2-16.25, 10-6in.
Built at	Pembroke Yard	*Rodney*, Chatham Yd. *Howe*, Pembroke Yd.	*Anson*, Pembroke Yd. *Camperdown*, Por'th.	Thames, I.W.
Engines by	Humphrys	*Rodney*, Humphrys *Howe*, Humphrys	*Anson*, Humphrys *Camperdown*, Maud'y	Maudslay
Armour belt	18-in.8in.	18in.-8in.	18in.-8in.	18in.-8in.
barbettes	14in.-12in.	11½in.-10in.	16in.-6in.	12in.-4in.
bulkheads ...	16in.-6in.	16in.-6in.	14in.-12in.	18in.-6in.*
Armament	4-12in., 6-6in., and smaller, 2 sub. and 4 above water tubes	4-13.5, 6-6in., and smaller as *Collingwood*	4-13.5, 6-6in., and smaller, as *Collingwood*	2-16.25, 10-6in., and smaller, as *Collingwood*

guns then available. These were 12-inch breechloaders in the *Collingwood*, and 13.5-inch in the other ships, except the *Benbow*, which mounted one 16.5 inch 110-ton in each barbette instead. An auxiliary armament was mounted inside the superstructure. The speed of these ships was about seventeen knots, and was considerably in excess of the average for the period.

As compared with the *Colossus* and *Edinburgh* class of the same date and era of design, the " Admirals " were somewhat inferior in armour protection, but because of that secured a far better speed and a greatly superior big gun command.

In all the " Admiral " class the armour weighed about 2,500 tons—say, 20 per cent. of the displacement. This proportion has never been very greatly varied from either before or since, and the popular idea that Barnaby designs sacrificed armour weight for other features is entirely incorrect. The real Barnaby ideal is better described (the conditions of his own time being kept in mind) as an attempt to put into practice " everything or nothing," so far as protection was concerned. To-day, a compromise is in fashion, and Barnaby is very much out of date. It may well be but a phase in the cycle of naval design. Properly to appreciate the *Admiral* class ideal, we have to translate it into the ideal which obtains to-day. Thus put, the *Admirals* would be somewhat swifter than our existing battle-cruisers, their vitals would be invulnerable and their armaments superior to that of any potential enemy. They would not, in fact, very greatly differ from Admiral Bacon's conception (published some five years before the present war) of the battleship of the future, in which he predicted the disappearance of much of the side armour of to-day.

Photo] [*Symonds & Co.*

THE *BENBOW*—A SHIP OF THE "ADMIRAL" CLASS.

The coming of the medium calibre quick-firer soon rendered the "Admirals" obsolete and even ridiculous. The medium calibre quick-firer profoundly modified design until the development of the big gun enabled it to act well beyond the effective range of the medium gun, and incidentally enabled it to fire nearly as fast as the elementary quick-firers were built to do. Thus we have come back to something very akin to the condition under which the Barnaby ships were designed.

These ships could not, perhaps, be described as an absolutely original idea, save in so far as the British Navy was concerned, since the Italian *Italia* was launched in the same year that the *Collingwood*, the first of the "Admirals" was laid down. The *Italia*, equally abnormally fast (or faster) for the period, carried four 100-ton guns échelonned in one large heavily armoured barbette amidships, but had no water-line belt whatever, and relied entirely upon an armour-deck to protect the motive power. In the "Admirals" the motive power was thoroughly protected by the vertical belt amidships, while flotation otherwise depended upon internal sub-divisions.

The "Admiral" class idea was re-developed into armoured cruisers in a somewhat curious fashion. At that time the French Navy was second in the world, and French ideas of construction commanded a great deal of respect. French notions at that era ran largely to single gun positions, four guns being separately disposed in four barbettes placed one ahead, one astern, and one on either side. The particular point of this arrangement was that while British designs accepted two or four big guns bearing, the French system allowed for a definite mean of three. More practically put, this may be translated into a conception that an enemy would use every effort to avoid positions in which four big guns could be brought to bear on him, and seek those in which he was exposed to two only. A gun-arrangement which gave three big guns bearing in *any* position seemed therefore far more reasonable on paper.

It stands to the credit of Sir N. Barnaby (or else to the credit of the Admiralty of the era) that he recognised the impossibility of any such manœuvres in fleet actions, but at the same time he also realised how heavily it might tell in cruiser duels. Out of which the *Imperieuse* and *Warspite* were born.

Details of these ships :—

Displacement—8,400 tons.

Length (between perpendiculars)—315ft.

Beam—62ft.

Draught (maximum)—27⅓ft.

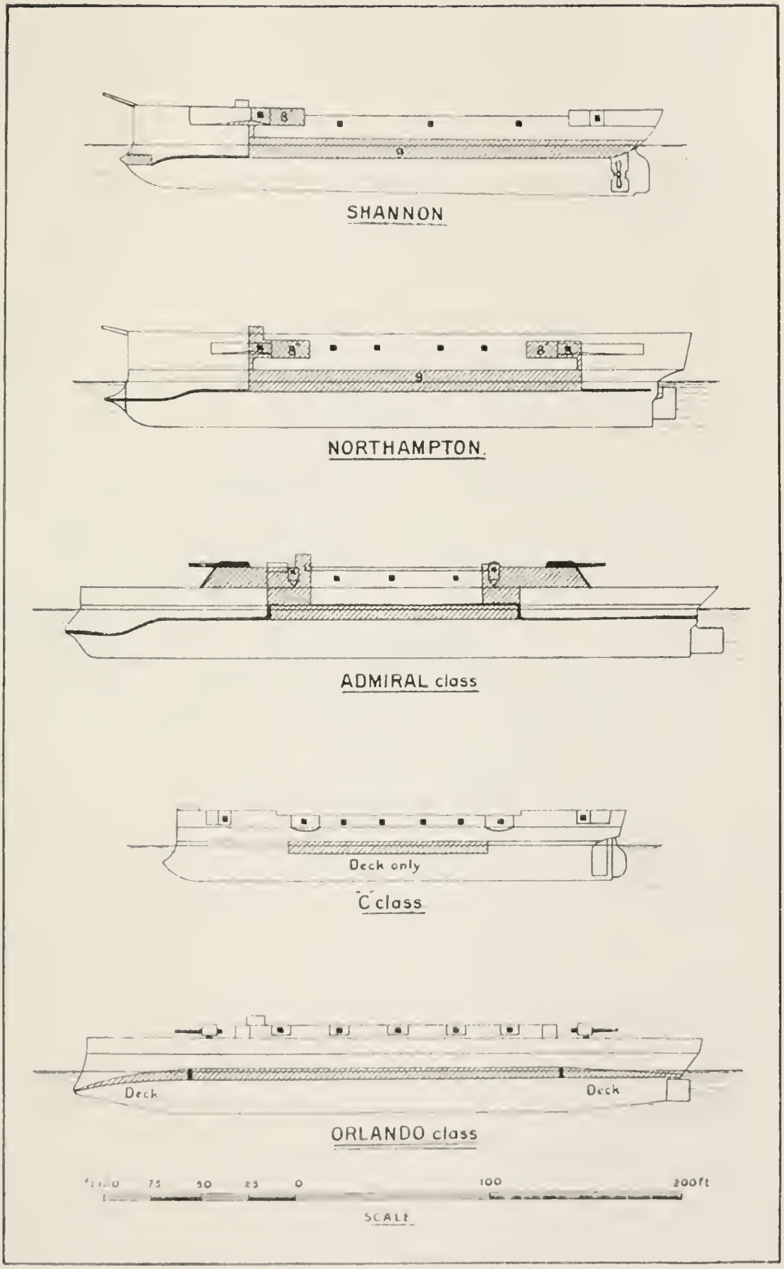
Armament—Four 9.2 24-ton B.L., six 6-inch, 89cwt., six torpedo tubes.

Horse-power—10,000=16.75 knots.

Coal—1,130 tons =nominal radius of ten knots of 7,000 miles.

Armour—Belt amidships of 10in. compound, with 9-inch bulkheads, 8-inch barbettes. No armour to lesser guns. 3-inch protective deck fore and aft, and on top of belt.

The *Imperieuse* was built at Portsmouth Dockyard and engined by Maudslay. The *Warspite,* built at Chatham, was engined by Penn. Both were completed in 1886 at a total cost of about £630,000 each. They were copper sheathed, and (like the *Inflexible*) originally were to carry a heavy brig-rig. This was removed at an early stage, and a single military mast between the funnels substituted. The *Imperieuse's* masts were sub-



CHARACTERISTIC BARNABY SHIPS.

sequently put in the *Northampton* (which see). Both proved faster than anticipated; but the coming of the quick-firer placed them in the semi-obsolete category almost as soon as they were completed. The type was never repeated. Till recently the *Imperieuse* still existed as a depot ship for destroyers; the *Warspite* has long since gone to the scrap heap. Years after their conception a modernised version of them was to some extent reproduced in the *Black Prince* class. In their own day, however, they appeared and that was all.

The "battleship of the future" ideal of those days had to some extent been foreshadowed in the *Benbow,* with her couple of 110-ton guns. The monster gun was "the vogue" and no way of carrying it on existing displacements allowed of more than two such pieces being mounted.

The idea of the moment became the mounting of guns capable of delivering deadly blows, and (corollary therewith) protection to ensure that that deadly blow could be delivered with relative impunity. Since the secondary gun had now come in, auxiliary guns and a secondary battery were a *sine quâ non*; but the ideal ship was to be one incapable of vital injury from such weapons. On lines such as these the *Victoria* class was designed.

The call was for an improved *Benbow.* The armament was to be no less and, if possible, more; while better protection was an essential feature.

Details of the *Victoria* type, of which only two were built, are as follows:—

Displacement—10,470 tons (approximately that of the *Benbow*).

Length (between perpendiculars)—340ft.

Beam—70ft.

Draught (maximum)—$27\frac{1}{4}$ft.

Armament—Two 110-ton guns (in a single turret), one 9.2 (aft), twelve 6-inch; twenty-one anti-torpedo guns, and six torpedo tubes (14-inch).

Armour (compound)—18-inch to 16-inch belt amidships, redoubt and bulkheads, 18-inch turret, 2-inch in battery. Armour deck, and heavily armoured conning tower.

Horse-power—14,000=16.75 knots.

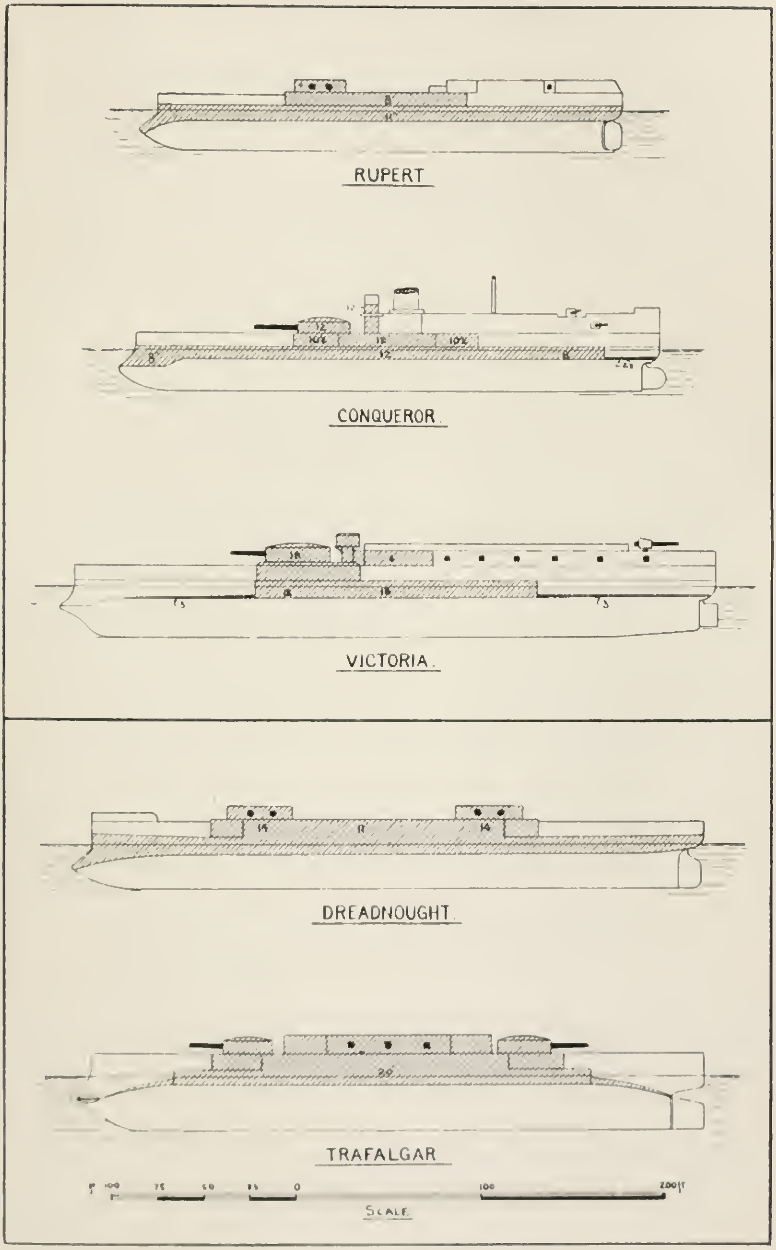
Coal—1,200 tons=7,000 miles at 10 knots.

The *Victoria* was built at Elswick and engined by Humphrys; launched in 1887 and completed for sea in 1889. The *Sanspareil*, engined by the same firm, but built at Blackwall (Thames Ironworks) was launched a year later, but completed about the same time.

The design of these ships closely approximated to the *Conqueror*, of which they were merely enlarged editions with a heavily increased battery.

The *Victoria* on completion became the flagship in the Mediterranean of Admiral Sir George Tryon. In the course of evolutions off the coast of Syria on June 22nd, 1893, she was rammed and sunk by the *Camperdown*. The disaster, which cost the lives of the Admiral and 321 officers and men, teaches no useful lesson, saving the danger of transverse bulkheads. Water-tight doors were shut too late. The sea entered. The ship gradually turned over, then suddenly "turned turtle" and capsized.

The mystery of her loss has never been fully explained. Admiral Tryon gave an order for the fleet, then in two lines, to turn inboard sixteen points, while at six cables apart. This manœuvre, with turning



TURRET SHIPS OF THE BARNABY ERA

circles as they were, was bound to create a collision. This was pointed out to Admiral Tryon, who, however, took no notice of the representations. It has since been assumed that he went suddenly mad. A more reasonable explanation is that he intended the ships to "jockey with their screws" (a manœuvre which he never employed as a rule), and forgot to mention the fact, though details of evidence in the court-martial hardly bear this out.

The exact signal as made was :—

"Second division alter course in succession sixteen points to starboard, preserving the order of the Fleet."

"First division alter course in succession sixteen points to port, preserving the order of the Fleet."

This signal was capable of more than one interpretation. Along one of them each ship in the two squadrons might easily have rammed the other in succession, according to some interpretations. Using screws, both divisions might have closed in very closely but quite safely. Acting other than simultaneously they might anyway have effected the manœuvre without disaster. At eight cables (a distance which was suggested to the Admiral an hour before) it might have been done quite safely. There have been other explanations also.

In the Fleet at the time everything was believed, except the "blunder" theory which has gone down to history. To this day that is accepted with reservation. But the rest is mystery.

The *Camperdown*, in turning, crashed into the *Victoria*, striking her forward, curiously enough directly on a bulkhead, just as the *Vanguard* was struck when she was rammed.

It was not expected that the *Victoria* would be sunk. Had the water-tight doors been closed during the manœuvre, instead of at the last moment, she would probably have remained afloat. As things were, it was impossible to close many at the time the order was given, but her low-freeboard also played a part. The sea invaded the door on the starboard side of the superstructure and thence got everywhere on that side of the ship. It was that which threw her over and capsized her, but the chance circumstance of the blow on the lateral bulkhead should not be forgotten. The *Victoria* was struck just on one of the points where all the odds were against her being struck.

The *Sanspareil* had an uneventful career, and was eventually sold out of the Service somewhat suddenly under the "scrap-heap" policy of Admiral Fisher in 1904.

Following upon the *Imperieuse* type, an entirely new class of armoured cruisers, the *Orlandos*, were designed. Just as the *Victorias* were improved and enlarged *Conquerors*, so the *Orlandos* were "improved *Merseys*." Particulars of these ships, of which seven were built altogether, are as follows:—

Displacement—5,600 tons.
Length (between perpendiculars)—300ft.
Beam—56ft.
Draught (maximum)—22½ft. (actually more).
Armament—Two 9.2in. B.L.; ten 6in.; and six torpedo tubes.
Armour (compound)—Belt amidships 10in., with 16in. Bulkheads. Protective deck at ends. All guns protected by shields only.
Horse-power—8,500=18 knots.
Coal (maximum)—900 tons=nominal radius of 8,000 miles.

BOARDING A SLAVE DHOW

They were built as follows:—

NAME.	BUILDER.	ENGINED BY
Orlando	Palmer	Palmer
Australia	Glasgow	Napier
Aurora	Pembroke	Thompson
Galatea	Glasgow	Napier
Immortalité	Chatham	Earle
Narcissus	Hull	Earle
Undaunted	Palmer	Palmer

They were laid down in 1885 and 1886. The *Orlando* was completed in 1888, all the others in 1889. They were launched in 1886 and 1887, and some of them, fitted with wooden guns ("Quakers"), served to swell the Fleet at the great Jubilee Review of 1887. All made over their designed speeds on trial, but they did their trials "light." In service all proved fairly useful, and the *Undaunted*, with Lord Charles Beresford as her captain in the Mediterranean, "made history" to the extent of first creating an Anglo-American *entente*, beginning with the U.S.S. *Chicago*, captained then by the now universally known naval author, Admiral Mahan. Beresford first achieved fame in the *Condor* at Alexandra, in 1882; but it was in the *Undaunted* that he first "made history" by ending the previously existing hostility between the British and U.S. Navies; and establishing the naval brotherhood of those who speak the same language.

The *Orlandos* were the last of the essentially Barnaby ships. Barnaby was associated with the Navy thereafter; but the *Nile* and *Trafalgar*, though produced under his régime, were not "Barnaby ships," and differences of opinion with the Admiralty about them eventuated in his resignation.

The tide of naval opinion was then setting back in the old *Dreadnought* direction. More complete protection was being demanded. The quick-firer was just coming in and its potentialities seemed enormous. The secondary battery had to be protected. Destruction of communications on board began to take on a fresh and more serious aspect. In a word, the Admiralty reverted to Reed ideas, and in reverting exaggerated them. In such circumstances the general idea of the *Trafalgars* was born.

Sir N. Barnaby totally dissented from the Admiralty line of thought. In his view the size of a ship could not legitimately be increased unless her offensive powers increased in proportion ; in the *Trafalgar* idea both speed and armament were reduced as compared to the *Admiral* class, and over a thousand odd tons added entirely to carry extra defensive armour. Over which dispute he resigned his position.

Details of the *Nile* and *Trafalgar* as built are :—

Displacement—11,940 tons.

Length (between perpendiculars)—345ft.

Beam—73ft.

Draught (mean)—27½ft.

Armament—Four 13.5-inch, six 4.7 Q.F., also smaller guns, and four 14-inch torpedo tubes, of which two were submerged.

Armour (compound)—Belt, 230ft. long (*i.e.*, 80ft. longer than in the *Admirals* and *Victorias*), 20-16in., with 16-14 inch bulkheads, protective deck at ends and over main belt.

Over this a redoubt 141ft. long, 18in. thick. Above the redoubt a battery, 4in. thick. Turrets, 18in.

Horse-power—12,000=17 knots.

Photo] [Russell & Sons.

SIR N. BARNABY.

A recent photograph.

Coal—(normal) 900 tons; (maximum), 1,200 tons =6,500 miles at 10 knots.

The *Nile* was built at Pembroke and engined by Maudslay. She was laid down in April, 1886, launched in March, 1888, and completed some two years later. The *Trafalgar* was laid down at Portsmouth in January, 1886, and launched in September, 1887. Her machinery was supplied by Humphrys. The armour of these ships weighed no less than 4,230 tons, *i.e.*, some 35 per cent. of the displacement instead of the more usual 25 per cent. or so. The then first Lord of the Admiralty took the occasion of the launch to remark that the days of such armoured ships were over, and that probably these were the last ironclads that would ever be built—the future would lie with fast deck-protected vessels! As, for three years, no more armoured ships were laid down, he at least enunciated a definite policy when these heavily armoured successors of the *Admiral* class were put afloat. They differed from the *Admirals* in that turrets were reverted to instead of barbettes, and, as already mentioned, they were really nothing but modernised versions of the old low freeboard *Dreadnought*.

At a later date 6-inch Q.F. were substituted for the 4.7's; but no other schemes of modernising the ships ever came to a head.

PROTECTED CRUISERS OF THE BARNABY ERA.

Four ships of the *Amphion* Class—*Amphion Arethusa*, *Leander*, and *Phœton*, of which the first (*Arethusa*) was laid down in 1880—represented the first Barnaby idea of the protected cruiser. They were of 4,300 tons displacement, and 16.5 knots nominal speed. They carried ten 6-inch guns, and a $1\frac{1}{2}$-inch deck amidships. According to the ideas of those days they were heavily over-gunned. They always steamed well; but it is doubtful whether Barnaby, left to himself, would ever have produced them. Incidentally, they were always bad sea-boats.

In 1883, completed about the same time as the *Victoria*, the *Mersey* class—*Mersey, Thames, Severn,* and *Forth*—of 4,050 tons displacement, and carrying two 8-inch and ten 6-inch, were commenced: practically early essays at the *Orlando* class idea which followed. The *Orlandos*, on only a thousand or so tons more displacement, carried 9.2's instead of 8-inch, had armour-belts as well as protective decks, and were a good knot faster. Both the *Amphions* and *Merseys* may be described as representing strictly naval Admiralty ideas—the *Orlando*, Barnaby ones. Each type was quickly rendered obsolete by the coming of the quick-firer; but the Barnaby type of cruiser, for 20 per cent. extra displacement, certainly offered better chances than any rival proposition, if only we consider matters in the light of what existed in those days and what promised best at that time.

So ends the Barnaby era. Barnaby's constructional ideas were blown to mincemeat by the advent of the quick-firer. Even to-day his ideas seem somewhat obsolete. Yet a few years hence (if big ships survive) they stand every chance of being reverted to, because to-day the big gun has more or less come back to where it was in 1875-1885. Barnaby, though he worked into its era, never realised the preponderance or possible preponderance of the "secondary gun." In his era it fired too slowly to count for very much; in our own, range neutralises whatever it may have accomplished in the rapidity of fire direction.

Likely enough, the reversion to Barnaby ideals, which is reasonably probable for the immediate future, will be merely a phase; and casual historians will ever put him down as the naval constructor who was least able to anticipate the years ahead of his creations. But a hundred years hence Barnaby may come into his own in a way little suspected to-day. A hundred years hence, when all the most modern ideas are ancient history, Barnaby may stand with Phineas Pett, and the Navy which he created stand for something infinitely more than the scrap heap to which a later age swiftly relegated it. Only the historian of the distant future can estimate him at his real value. His own generation never placed much faith in his ships; the generation that followed generally regarded them with scorn. It was probably wrong, but only the future can prove it to have been so.

GUNS IN THE ERA.

The guns which especially belong to the Barnaby era were as follows:—

Cal. ins.	Weight in tons.	Length in cals.	Weight projectile lbs.	Muzzle velocity f.s.	Muzzle energy. ft.	Penetration 2000 yds.	
						iron.	comp.
M.L.							
16	81	18	1684	1590	29,530	22	15
B.L.							
16.25	110	30	1800	2148	57,580	29	19
13.5	67	30	1250	2025	35,560	26	17
12	45	25	714	2000	18,060	19	12½
9.2	22	25	380	1809	8622	15	10
8	14	30	210	2200	7060	14	9
6	5	26	100	1960	2665	8	5

In the early part of the period, guns of the Reed era, down to the 10-inch 18-ton M.L., were also made use of; but generally speaking, the Barnaby designs coincide with early breechloading types. It is interesting to note that the 81-ton gun figured in one ship only (the *Inflexible*), and that after this the 38-ton 12.5 M.L. was reverted to, to be replaced in later designs by the 45-ton 12-inch B.L.

The M.L. guns available for early Barnaby designs were considerably superior to earlier examples of their type; as after the fiasco of the *Glatton* trials,* copper gas checks were introduced. These were affixed to the base of the projectile and expanded on firing. They led to a certain increased power and accuracy; but, even so, only of a relative nature compared with the better results obtained from breechloaders. The *Thunderer* gun disaster, which after many experiments was found to have been caused by doubly loading the gun, added another argument to the anti-muzzle-loader cause.

The 12-inch, which was the first large B.L. to be introduced, compared as follows with the 12-inch M.L. :—

Gun.	Length in cals.	Weight tons.	Muzzle energy. ft.	Weight of projectile lbs.	Penetration of iron at Muzzle. in.	Penetration of iron at 1000 yds. in.	Penetration of iron at 2000 yds. in.
12in. M.L.	13½	35	9470	706	16	15	13
12in. B.L	25	45	18,060	1250	30½	28	26

The enormous difference in efficiency was of course traceable to other causes than the adoption of the breech-loader instead of the old M.L.; but this was, equally naturally, overlooked; which, perhaps, was just as well—otherwise the muzzle-loader might have persisted to quite recent times. Though the *Thunderer* disaster showed that a M.L. could be loaded twice over by accident, this was an obviously unlikely thing to occur again. The impression was made by the fact that the 12-inch B.L. was far more powerful than the old

* *See* Reed Era.

16-inch M.L. It was possibly this which directly led to the "monster-gun craze" of the Barnaby era, the way to which had already been shewn by the 16-inch M.L. Incidentally it is interesting to note that the present monster gun era is the third in which, after a period of adhesion to a 12-inch gun, greatly increased calibres have suddenly and more or less generally been resorted to.

THE COMING OF THE TORPEDO.

Reference has been made in the past chapter to Sir E. J. Reed's recognition of the possibilities of the torpedo; and floating mines were, of course, well known. It was not, however, till 1874 that either mine or torpedo came to be regarded at all seriously.

The earliest Whitehead "fish torpedo" was produced in 1868; though it was then little more than a curiosity. It was a crude weapon, although it embodied, with two notable exceptions, most of the features that it possesses to-day. Its motive power was compressed air; it carried an explosive head with a sensitive pistol.

The secret was bought by the British Government at an early stage. It was made strictly confidential; indeed, to the present day, the internal mechanism of a torpedo is more or less sacred. Most other nations purchased the secret also, and guarded it with like care!

It is but fair to add that this ridiculous situation was brought about by the inventor, who particularly specified that the balance chamber must not be revealed even to admirals commanding fleets, but only to specially selected officers.

A main difficulty with the torpedo was how to discharge it. For some while only two methods existed: the first, a mechanism of catapult type which hurled the torpedo into the water ; the other, by a crude application of dropping gear, suitable, of course, for launches only. In either case, especially the former, there was a strong element of uncertainty as to the direction the torpedo would take ; for one to describe a circle and return to the firer was not unknown.*

The charge was inconsiderable, and range and speed were both very small.

An instrument called the Harvey torpedo was more or less contemporaneous with the Whitehead. It was a very primitive idea, consisting as it did merely in attempting to tow explosives across the course of an enemy. It was too obviously cumbersome to cause disquietude, and with the invention of torpedo tubes passed into oblivion.

The advantages of the torpedo tube were quickly recognised ; and though the range was still little over a hundred yards or so—at any rate, so far as any probability of hitting was concerned—the torpedo quickly became a part of the armament of all important ships. So much was this the case that the submerged tube was developed with sufficient celerity to be adopted into the equipment of the *Inflexible*, of 1874 design.

None the less, however, the possible results of torpedo attack remained uninvestigated till 1874, and even then only came to be inquired into after the *Oberon* experiments, which were primarily if not entirely brought about by the advent of the observation mine as a practical thing.

The mine's arrival counted for little ; the automobile torpedo being at the moment much in the public eye, the

* In the Chili-Peruvian War—as late as 1879-81—a torpedo fired from the *Huascar* did this.

point that the *Oberon* experiments were primarily designed to test the effect of mines got somewhat lost sight of. The essential fact is that by 1874 the fact of other enemies to the ship than the gun was established. For a long time it affected ship design no further than the gradual introduction of an anti-torpedo-boat armament; but this was mainly due to Sir E. J. Reed having in the *Bellerophon* design endeavoured to anticipate torpedo effect. In 1874, and onward therefrom for some time, the double bottom, combined with water-tight bulkheads, was considered a suitable "reply" to the "new arm," and it was not for many years that torpedo nets were in any degree appreciated.

In the later eighties some torpedo experiments were conducted against the old ironclad *Resistance*, in which the Bullivant net defence system proved altogether superior to the cumbersome old wooden booms which were in use: but, despite this, nothing was done for many a year, and the old pattern was adhered to.

ESTIMATES IN THE ERA.

Financial Year.	Amount.	Personnel.
1869	9,996,641	63,000
1870	9,370,530	61,000
1871	9,789,956	61,000
1872	9,532,149	61,000
1873	9,899,725	60,000
1874	10,440,105	60,000
1875	10,825,194	60,000
1876	11,288,872	60,000
1877	10,971,829	60,000
1878	12,129,901	60,000
1879	10,586,894	58,800
1880	10,566,935	58,800
1881	10,945,919	58,100
1882	10,483,901	57,500
1883	10,899,500	57,250
1884	11,185,770	56,950
1885	12,694,900	58,334

II.

THE WHITE ERA.

THE appointment of Sir William White as Chief Constructor more or less synchronised with a considerable revolution in naval construction and ideas. The institution of naval manœuvres drew great attention to the sea-going quality of various types of ships. The manœuvres of 1887 mostly centred around the *Polyphemus*, and her charging a boom at Berehaven. Little was here proved except that boom defences were easily to be annihilated. In 1888, however, the manœuvres were of a much more extensive nature, and a Committee was appointed to consider and report upon them, especially with regard to the following points :—

"The feasibility or otherwise of maintaining an effective blockade in war of an enemy's squadron or fast cruisers in strongly fortified ports, including the advantages and disadvantages of—

(a) Keeping the main body of the blockading Fleets off the ports to be blockaded with an inshore squadron.

(b) Keeping the main body of the blockading Fleets at a base, with a squadron of fast cruisers and scouts off the blockaded ports, having means of rapid communication with the Fleet.

(c) In both cases the approximate relative number of battleships and cruisers that should be employed by the blockading Fleet, as compared with those of the blockaded Fleet.

Photo] [Russell & Sons.

SIR WILLIAM WHITE.

" The value of torpedo-gunboats and first-class torpedo boats both with the blockading and blockaded Fleets, and the most efficient manner of utilising them.

" As to the arrangements made by B squadron for the attack of commerce in the Channel, and by A squadron for its protection.

" As to the feasibility and expediency of cruisers making raids on an enemy's coasts and unprotected towns for the purpose of levying contribution.

" As to the claims and counterclaims made by the Admirals in command of both squadrons with regard to captures made during the operation.

" As to any defects of importance which were developed in any of the vessels employed, and their cause."

As Supplementary Instructions there were :—

(1) As to the behaviour and sea-going qualities of, or the defects in, the new and most recently commissioned vessels, as obtained from the reports of the Admirals in command of the respective squadrons.

(2) The general conclusion to be drawn from the recent operations."

A summary of the findings* is as follows :—

" That to maintain an effective blockade of a Fleet in a strongly fortified port a proportion of at least five to three would be essential and possibly an even larger proportion, unless a good anchorage could be found near the blockaded port which could be used as a base, in which case a proportion of four to three might suffice, supposing the blockading squadron to be very amply supplied with look-out ships and colliers."

Torpedo boats were condemned as being of little value to blockaders, though useful to the blockaded. For blockade purposes the torpedo-gunboats of the *Rattlesnake* class were highly commended.

Attention was drawn to the large number of deck hands employed down below on account of the insufficient

* The full report is to be found in Part IV of *Brassey's Naval Annual*, 1888-9.

engine-room complements, and the excess of untrained stokers. The case of the *Warspite* was specifically mentioned. In order to break the blockade at sixteen knots she sent thirty-six deck hands down below at a time when every available deck hand would have been required above had the operations been real war.

A special supplementary report was called for as to the sea-going qualities of the ships. Considerable historical interest attaches to this particular report, and the following extracts are especially interesting :—

Admiral class.

"So far as could be judged, these vessels are good sea-boats, and their speed is not affected when steaming against a moderate wind and sea ; but we are of opinion that their low freeboard renders them unsuitable as sea-going armour-clads for general service with the Fleet, as their speed must be rapidly reduced when it is necessary to force them against a head sea or swell.

"On the only occasion on which the *Collingwood* experienced any considerable beam swell she is reported to have rolled 20 degrees each way ; this does not make it appear as if the *Admiral* class will be very steady gun-platforms in bad weather.

"They are said to be 'handy' at 6 knots and over.

"In the *Benbow* much difficulty was experienced in stowing the bower anchors. This is the case in all low freeboard vessels, more or less, but the evil appears to have been intensified in this instance by defective fittings, and by the fact of her being supplied with the old-fashioned iron-stocked anchors instead of improved Martins.

"Serious complaints are made from these ships that the forecastles leak badly, and that the mess-deck is made uninhabitable whenever the sea breaks over the forecastle at all ; it would seem that this defect might be remedied."

This opinion was not shared by Admiral Sir Arthur Hood, who commented as follows :—

"I cannot concur in this opinion, my view being that the objects of primary importance to be fulfilled in a first-class battleship are : (1) That, on a given displacement, the combined powers of offence and defence shall be as great as can be given ; (2) that she shall be handy and possess good speed in ordinary weather, combined with sea-worthiness ; (3) that she shall have large coal-carrying capacity. I certainly do not consider that the *Admiral* class, which, on account of their comparatively low freeboard forward, must have their speed reduced when steaming against a heavy head sea or swell to a greater extent than is the case with the long, high freeboard, older armour-clads, as the *Minotaur, Northumberland, Black Prince* are for this reason rendered unsuitable as sea-going armour-clads for general service with a Fleet. The power of being able to force a first-class battleship at full speed against a head sea is not, in my opinion, a point of the first importance, although in the case of a fast cruiser it certainly is. Admiral Tryon draws an unfavourable comparison between the speed of the new battleships and that of the long ships of the old type, when steaming against a head sea. I admit at once that vessels like the *Minotaur* class would maintain their speed and make better weather of it when being forced against a head sea than would the *Admirals ;* but this advantage, under these exceptional conditions, cannot for a moment be compared with the enormous increase in the power of offence and defence possessed by the *Admirals*."

The *Conqueror* and *Hero* were reported to roll a great deal. Being short they felt a head sea quickly, and on account of their low freeboard it was found impossible to drive them against a heavy sea at anything approaching full speed. Incidentally these ships were known as "half-boots."

Here, again, Admiral Sir Arthur Hood dissented. In connection with these points, Admiral Tryon submitted a report in which he emphasised, as he had done with the *Admirals*, that however fast these short ships might be in smooth water, their speeds fell off rapidly in a seaway.

The *Mersey* class were described as being handy, steady gun platforms and able to fight their guns longer than most ships.* The captain of the *Severn*, however, reported a view that the 8-inch guns should be removed and lighter pieces substituted. Admiral Baird agreed with this. Sir Arthur Hood, in his comments, stated that he was "decidedly opposed" to any reduction of armament, both in this case and that of the other cruisers.

The *Arethusa* type were reported to roll so heavily when the sea was abeam or abaft that "accurate shooting would be impossible and machine guns in the tops would be useless."

The Committee concurred with Admiral Baird that the armament of these should be reduced.

For the *Archer* class it was unanimously suggested that lighter guns should be fitted forward. Sir Arthur Hood agreed with this view, which, however, was never carried into effect.

Particular interest attaches to the *Rattlesnake*† class of torpedo-gunboats—these vessels being really prototypes of the destroyers of the present day. They were reported as "safe, provided they were handled with care." Their handiness was unfavourably reported on. It was strongly urged that the 4-inch gun mounted forward should be removed. This, however, was never done.

With reference to any new vessels of this type, the Committee reported as deserving immediate consideration :—

(1) Generally strengthen the hull in this type of vessel.

* It is worthy of note that these ships were abnormally "over-gunned" according to the ideas which were then in official favour, and which, later on, came more into favour still. The same applies to the *Arethusa* class.

† It is interesting to note that the Laird firm, who built the *Rattlesnake*, which was easily the fastest of her class, made her engines considerably heavier than Admiralty specifications. For this they were fined £1,000, which sum, however, was remitted after the brilliant success of the ship in the manœuvres above referred to.

(2) Raise the freeboard forward.
or (3) "Turtle-back" the forecastle.

In the gunboats that followed the freeboard forward was considerably raised; but when destroyers came to be built several years later, it is interesting to observe that the turtle-back forecastle was adopted, and it was not till after over a hundred had been built that the high forecastle, recommended so long before, appeared in the *River* class.

The report concluded:—

"The proportion of untrained (2nd class) stokers which were drafted to several of the ships appears to have been too large; in point of physique they are reported as unequal to their work, and in many instances the experience of these men in stokehold (or any other work on board ship) was nil.

"As a means of affording opportunities for training newly-raised stokers we recommend that at least one year should be served by them as supernumerary in a sea-going ship before they are considered fit to be draughted as part complement to any vessel; we further are of opinion that a Committee should be appointed to inquire into the sufficiency or otherwise of the complements allowed in the steam department of each class of ship, the proportion of 2nd class stokers which should be borne, and the amount of training which they should be required to undergo before they can usefully be borne as part complement in a fighting ship."

An agitation as to the state of the Navy, which was commenced in the year 1887, mainly by the initiative of the *Pall Mall Gazette*,* finally resulted in the passing of the Naval Defence Act of 1889. This provided for the construction of a total of seventy vessels, consisting of ten armoured ships, nine first-class cruisers, twenty-nine second-class cruisers, four third-class and eighteen

* Mr. W. T. Stead, who edited the *Pall Mall Gazette* at that time, intimated some twenty years later that Lord Fisher was behind him in commencing the agitation. Lord Charles Beresford, then in political life, brought the Bill forward.

torpedo gunboats, to be built as quickly as possible at the estimated cost of £21,500,000.

The substantial part of the programme of 1886 had consisted of two big turret ships, the *Nile* and *Trafalgar*, and two armoured cruisers, *Immortalité* and *Aurora* of the *Orlando* class. In 1887 nothing larger than second-class cruisers was laid down; and in 1888 the most important vessels on the programme were only the protected cruisers, *Blake* and *Blenheim*. There was, therefore, ample material for panic.

Details of the *Blake* class:—

Length (*p.p.*)—375 ft.

Beam—65 ft.

Guns—Two 9·2 in., 22-ton B.L.R., ten 6-in. Q.F., eighteen 3-pdr.

H.P.—20,000.

Designed speed—22·0 kts.

Coal—1500 tons.

Builder of Ship—*Blake*, Chatham; *Blenheim*, Thames Ironworks.

Builder of machinery—*Blake*, Maudsley; *Blenheim*, Thames Ironworks.

Launched—*Blake*, 1889; *Blenheim*, 1890.

Special features of these ships were a combination of the armament of the *Orlando* class with greatly increased speed secured by the development of deck armour in place of the belts of the *Orlando* class. In so far as a special type of ship may be said to be the development of some predecessor, the *Blake* and *Blenheim* may be described as enlarged *Merseys*. They were, however, unique on account of their relatively great length and great increase of displacement as compared with preceding vessels. In them the armoured casemate, a leading characteristic of nearly all Sir William White's ships, made its first appearance. It was employed in the *Blake* and *Blenheim* for four main deck guns, the upper deck guns being behind the usual shields.

The coming of the casemate, curiously enough, attracted little attention, compared to its importance. It may be said to have rendered possible the return to main deck guns in unarmoured ships. In the *Orlando* class, ten 6-inch guns were all bunched together on the upper deck amidships. Since these ships were designed the 6-inch quickfirer had made its first appearance, and the largest possible distribution of armament was therefore desirable. The adoption of the two-deck system of the *Blake* and *Blenheim* secured this much larger distribution, rendering it impossible for a single shell to put more than one of the five broadside 6-inch out of action, whereas in the *Orlando* class at least three guns were at the mercy of a single shell.

Another novelty of the type was the introduction of a special armoured glacis around the engine hatches. This system had, of course, been used before in the Italian monster ships *Italia* and *Lepanto*, but it was first introduced in the British Navy in the *Blakes*.*

The ships were very successful steamers, for all that neither made her expected twenty-two knots on trial.

Trial results :—

Blake : Eight hours' natural draught, mean I.H.P.–14,525=19.4 knots.

Blenheim : Eight hours' natural draught, mean I.H.P.—14,925=20.4 knots.

* In 1899 the *Blake* was re-boilered. The ships remained upon the effective list till 1906, when they were converted into sea-going depot ships for destroyers, most of their guns being removed. They now carry each 670 tons of coal of their own, and 470 tons stowed in one cwt. bags for use by destroyers.

Blake : Four hours' force draught, mean I.H.P.—19,579=21.5 knots.

Blenheim : Four hours' forced draught, mean I.H.P.—21,411=21.8 knots.

The principal item of the Naval Defence Act was eight first-class and two second-class battleships. All these ships were designed by Sir William White, and may be described as battleship editions of the *Blake* and *Blenheim*, so far as the disposition of their armament was concerned. For the rest they may be described as attempts to combine in one ship the best features of the Read and Barnaby ideals. In place of the low freeboard of the *Admiral* class, seven of the *Royal Sovereigns* were given high freeboard fore and aft, with the big guns about twenty-three feet above water. The eighth ship, the *Hood*, was modified to suit the ideals of Admiral Hood, and was to some extent an improved *Trafalgar*, her big guns being in turrets some seventeen feet above the water, in turrets instead of *en barbette*, with guns exposed as in the rest of the class.

In them, among other special features, 18-inch torpedo tubes were first introduced instead of 14-inch, and a stern torpedo tube appeared.

The original idea of end-on torpedo tubes was torpedo attack from the bow in place of the ram. The *Polyphemus* was the first ship in which an end-on tube appeared (submerged). In cruisers of a later date the bow tube was found to injure speed, and there was always the danger of a ship over-running her own torpedo. On this account the bow-tube never secured in the British Navy that vogue which it obtained, and still has, in Germany.

The stern-tube appears to owe its origin to an idea that a defeated or overpowered ship, running from an enemy, might save herself by it: dim ideas of "runaway tactics" had also begun to appear.

Sir William White never claimed for himself that he had anticipated the future in any way in his torpedo armament, even when defending himself against criticisms, to the effect that he "gave too little for the displacement." Yet his torpedo innovations, besides discounting the future, all helped to swell the total weight; as also did many internal strengthenings of the kind which do not show on paper. Possibly he did not realise his own greatness as the designer of a class of ship which was so much better than any contemporary vessel, that even in these days of "Super-Dreadnoughts" the *Royal Sovereigns* are still looked back upon with respect, and invariably regarded as marking the beginning of an entirely new phase in ship construction.

In April, 1889, their designer read a paper about them at the Institution of Naval Architects, in which the principal points which he claimed were that much superior command of guns was given, and that the auxiliary armament was nearly three times the weight of that of the *Trafalgars*. The following points were also mentioned by him:—

"(*a*) 'That (it was officially decided that) it was preferable to have two separate strongly protected stations for the four heavy guns, rather than to have a single citadel.'

"(*b*) 'That on the whole the 4-inch armour amidships, from the belt deck to the main deck, associated as it would be with the internal coal bunkers, sub-divided into numerous compartments, might be considered satisfactory; but that if armour weight became available, it could be profitably utilised in thickening the 4-inch steel above the middle portion of the belt.'

"I would draw particular attention to the first of these conclusions, since it expresses a most important distinction between the two systems of protection.

"With separate redoubts, placed far apart, the two stations are isolated, and there is practically no risk of simultaneous disablement by the explosion of shells, or perforation of projectiles from the heaviest guns. Each redoubt offers a small target to the fire of an enemy, and its weakest part—the thick steel protective plating on the top—is of so small extent that the chance of its being struck is extremely remote. Serious damage to the unarmoured turret bases therefore involves the perforation of the thick vertical armour on the redoubts.

"With a single citadel, extending the full breadth of a ship, the case is widely different.

"Over a comparatively large area of the protective deck-plating in the neighbourhood of each turret, perforation of the deck, or its disruption by shell explosions at any point, involves very serious risk of damage to the turret bases and the loading apparatus. In fact, such damage may be effected and the heavy guns put out of action while the thick vertical armour on the citadel is uninjured. Moreover, as the turrets stand at the ends of a single citadel, there is a possibility of their simultaneous disablement by the explosion of heavy shell within the citadel.

"This last risk may be minimised (as in the *Nile* and Trafalgar) by constructing armoured 'traverses' within the citadel; but it cannot be wholly overcome, so long as both turrets stand in one armoured enclosure.

"It may be thought that the risk of damage to a 3-inch steel deck situated 11 ft. above water is remote; but I think the facts are as stated, when actions at sea are taken into account.

"For example, if a ship of 70 to 75 ft. beam is rolling only to 10 degrees from the vertical, which is by no means a heavy roll, she presents a target having a vertical (projected) height of 13 to 14 ft. to an enemy's fire, and even if she is a steady, slow-moving ship, she will do this four or five times in each minute.

"Now, at this angle of inclination, assuming the flight of projectiles to be practically horizontal, even the thickest protective steel decks yet fitted in battleships are liable to serious damage from the fire of guns of moderate calibre, and this danger is increased by the employment of high explosives. Of course, I do not mean to say that this damage is to follow from fire intentionally aimed at the protective deck; but with a great and sustained volume of fire, such as is possible with a powerful auxiliary armament, and especially with quick-firing guns, it is obvious that there is a very real danger of chance shots injuring seriously the wide expanse of the protective deck at the top of a long citadel.

"Again, it must be noted that the chances of damage to a deck placed 10 or 11 ft. above water, and with large exposed surfaces in the neighbourhood of the turrets when a ship is inclined or rolling, are greater far than those of a deck 7 or 8 ft. lower, and with 5-inch armour on the sides protecting the deck from the direct impact of shells containing heavy bursters. It is for the naval gunner to estimate these chances of injury; but, unless I am greatly mistaken, their verdict will be that a far greater number of shots are likely to strike at a height of 8 to 10 ft. above water than at a height of 4 to 5 ft.

"These considerations, I submit, amply justify the selection of the separate redoubt system, in association with the thin side armour above the belt, and the lowering of the protective deck to the top of the belt in the new designs.

"It may be urged that, if the redoubt system be adopted, it should be associated with side armour and screen bulkheads of greater thickness than 5-inch steel, and more strongly backed. This is perfectly practicable, but necessarily costly, involving an additional load of armour, and a corresponding increase in the size of the ship."

The designs were vigorously criticised by Sir Edward Reed, whose chief objections centred on the fact that the lower-deck protection was thin armour only. Sir William White combatted this idea, and proved very conclusively that, according to the needs of the moment, his views were correct. It is, however, worthy of record that at a later date with the *Majestic* class (see a few pages further on), he effected modifications which brought his ships more into line with what Sir Edward Reed had advocated. It should, however, be mentioned that this was not done until improvements in armour construction rendered possible things that were certainly impossible in the days of the *Royal Sovereigns.*

In connection with the later career of the *Royal Sovereign* class these items may be added. On completion they were found to be singularly simple in all their internal arrangements, and extraordinarily strong. When they went to the scrap-heap in 1911-12, they were, constructionally, practically as good as when built. They proved to be good sea boats, but at first rolled very badly, which resulted in their getting an unenviable notoriety in this respect. This was, however, completely cured by the fitting of bilge keels, after which the ships were everything that could be desired in the way of being steady gun platforms.

The ever increasing vogue of the quickfirer tended to render them rather quickly obsolescent over things which to-day would count much less than they did in the past. The defects of the *Sovereigns*, as realised not very long after completion, were :—

(1) That the big guns' crews were practically unprotected, and easily to be annihilated by the newly-introduced high explosive shells of the secondary armament of an enemy.

(2) Only four of the ten 6-inch were armour protected, which also was considered a fatal drawback.

In the first case nothing was ever done ; but in the second, about the year 1900, casemates were fitted for the upper-deck guns of all ships except the *Hood*,*

* This ship very greatly exceeded her nominal displacement of 14,200 tons. She was actually 15,400 tons. The essentially White ships were, on the other hand, of about their nominal displacement. Of the *Hood* it may further be added that she was greatly inferior to the others as a sea-boat—a serious set-off against her superior big gun protection.

which on survey was found unsuitable for such reconstruction.

The only thing that remains to add is that although in the course of years the ships lost the speeds for which they were designed, up to the very end they proved capable of doing about thirteen knots indefinitely.

In addition to the *Sovereigns* two "second-class battleships" were built, the *Centurion* and *Barfleur*, of which details are :—

Displacement—10,500 tons. Complement, 620.

Length—(Waterline) 360ft.

Beam—70ft.

Draught—(Maximum) 27ft.

Armament- Four 10-inch, ten 4.7-inch, eight 6-pounders twelve 3-pounders, two Maxims, two 9-pounder boat guns. Torpedo tubes (18-inch)—two submerged and one above water in the stern.

The *Barfleur* was laid down at Chatham in November, 1890, launched in August, 1892, and completed two years later. The *Centurion*, laid down at Portsmouth in March, 1891, was launched a year later, but completed before her sister.

The ships were armoured generally on the *Royal Sovereign* plan, with 12-inch belts which, however, were only 200ft. long, instead of 250ft. The bulkheads were six inches only, and the upper belt (nickel steel) an inch less than in the big ships. The barbettes were reduced to nine inches only, but on the other hand were made circular instead of pear-shaped, and 6-inch shields were provided for the big guns—probably as the result of criticisms of the unprotected big guns of the *Sovereigns*. With a few early exceptions as to the shape of the base, and with certain variation in form, this kind of "turret" has been adhered to ever since in the British Navy and copied into every other.

Both ships were engined by the Greenock Foundry Company, and designed for 13,000 H.P., with forced draught, giving a speed of 18.5 knots, which speed both exceeded on trial. This high speed and their coal endurance—they carried a maximum of 1,125 tons, sufficient for a nominal 9750 mile radius—makes them something more than the "second-class battleships" which they nominally were.

Compared to the *Sovereigns* they were :—

Minus Points :	*Barfleurs.*	*Sovereigns.*
Displacement (tons)	10,500	14,100
Principal guns	4-10in., 10-4.7	4-13.5, 10-6in.
Armour belt	12 inches.	18 inches.
Plus Points :		
Horse Power	13,000	13,000
Speed	18.5	17
Nominal endurance (kts.).	9,750	7,900

From which the existence of an elementary conception of the "battle-cruiser" of to-day seems fairly apparent. To-day the battle-cruiser, instead of having guns of reduced calibre, carries a reduced number, but the general principle of "moderate sacrifices for increased speed" obtains.

The *Barfleur* and *Centurion* proved excellent steamers and good sea-boats. Their defect was their weak armament, and in 1903 it was decided to remedy this. In that year they were "reconstructed." Their 4.7's were taken out and 6-inch guns substituted, and the six on the upper deck were put into casemates. As a species of make-weight the foremast was taken out of both ships; but this made little difference. The "improvements" were a total failure; the ships were immersed far below what they had been designed for, and they never thereafter realised much more than about sixteen knots. Within seven years they were removed from the Navy List altogether, and such service as they performed after modernising was entirely of a subsidiary order.

For the first-class cruisers of the Naval Defence Act reduced examples of the *Blenheim* were decided on. These vessels were the *Edgar*, *Endymion*, *Grafton*, *Hawke*, *St. George*, *Gibraltar*, *Crescent*, and *Royal Arthur* (formerly designated as the *Centaur*). They were launched between 1891 and 1892, averaging 7,350 tons (unsheathed) and 7,700 tons (sheathed and coppered, in the case of the last four mentioned). Except the two last, all had the *Blenheim* armament of two 9.2 and ten 6-inch. The two latter had a couple of extra 6-inch on a raised forecastle substituted for the forward 9.2.

No attempt was made to obtain the high speed of the *Blenheims*—19.5 knots being the utmost aimed at. Not only, however, did the *Edgar* class exceed expectations on trial, but they proved most remarkably good steamers in service. No engine-room defects of moment were ever encountered in any of them, and twenty years after launch most were still able to steam at little short of the designed speed. Like the battleships, they were given 18-inch torpedoes in place of the 14-inch of the *Blenheims*.

In the course of their service careers, the *St. George* (or rather her crew) earned distinction in the Benin Expedition. The *Crescent* was served in by King George V, and the *Hawke* achieved notoriety by ramming the *Olympic* in the Solent in 1911.

The lesser cruisers of the Naval Defence Act numbered altogether 28. Of these twenty belonged to the *Apollo* class of 3,400 tons (unsheathed) and 3,600 tons (sheathed). They were *Apollo, Andromache, Latona, Melampus, Naiad, Sappho, Scylla, Terpsichore, Thetis, Tribune* (unsheathed), and *Aeolus, Brilliant, Indefatigable* (named *Melpomene* in 1911), *Intrepid, Iphegnia, Pique, Rainbow, Retribution, Sirius, and Spartan* (sheathed).

In all, the armament was two 6-inch and six 4.7, with lesser guns, and, above-water, 14-inch torpedo tubes. The speed was twenty knots in the unsheathed, and a quarter of a knot less in the sheathed ones.

When built all proved able to steam very well, but after some years service certain of them fell off very badly in speed. Others, however, remained as fast as when they were built—the *Terpsichore*, in 1908, averaging 20.1 knots, and the *Aeolus*, in 1909, nearly nineteen knots.

During their service, the *Melampus* was commanded by King George as Prince George, while the *Scylla*, under Captain Percy Scott, gave birth to the "dotter," and the "gunnery boom" which followed. In 1904 and onwards seven of them, scrapped from regular service—the *Latona, Thetis, Apollo, Andromache, Iphegnia Intrepid*, and *Thetis*—were totally or partially disarmed and converted into mine layers.

The remaining eight cruisers of the Act—*Astræa, Bonaventure, Cambrian, Charybdis, Flora, Forte, Fox*, and *Hermione*—were increased in size up to 4,360 tons, and given a couple of extra 4.7, and 18-inch in place of 14-inch tubes. Instead of their 4.7's being mounted in the well amidships, they were placed on the upper deck level, a much better position in a sea-way, but they never proved themselves quite such good ships for their

SECOND CLASS CRUISER OF THE NAVAL DEFENCE ACT ERA. NOW CONVERTED INTO A MINE-LAYER

size as did the earlier type. They served to illustrate the general rule that slight improvements on a design are rarely satisfactory, and that while every staple design has its defects, it is extremely difficult to remove one drawback without creating another. Moreover, such improvements invariably cause increased cost, and an essential with the small cruiser is that she shall be cheap enough to be numerically strong. Four *Astræas* cost as much as five *Apollos*. They were rather more seaworthy, but no faster—if as fast. The total broadsides obtained were only *one* 4.7 more and *two* 6-inch *less*.* A considerably greater possible bunker capacity was obtained; but the normal supply (400 tons) was the same for both.

In the British Navy, in 1908-11, a precisely similar thing obtained. It was probably inevitable. In the German Navy, between 1897 and 1907, displacement for small cruisers rose from 2,645 to 4,350 tons, with practically the same armament. But here the horsepower rose from about 8,500 or less to 20,000, and designed speeds in proportion, from a twenty-one knots (not made) to a 25.5, which, on trial, turned out to be 27,000 I.H.P. and over twenty-seven knots.

Here, however, there was a definite aim—increased speed, with only trivial improvements in any other direction. With similar British cruisers the defect has invariably been "general improvements" on what the original design *might have been* if plotted a year or two later than it actually was. There is no question—or very little—but that Germany in its ultra-conservative policy gauged the situation better than any British Admiralty ever did till just before the war.

* 4 *Astræas* = 8—6in., 16—4.7. 5 *Apollos* = 10—6in., 15—4.7

Minor cruisers *must* be cheap to construct. Any improvement in them *must* have a definite intrinsic value. Lacking that, it is worth very little. The *Astræas*, as cited, indicated how a supposed advantage may even be a real deficit from another point of view.

The value of increased speed cannot be put into £ s. d., but armament easily can be. Like reconstruction, minor "improvements" on a design rarely pay. With the original conception the naval architect is given certain data for which he arranges accordingly. Ordered to improve upon it in any direction he can only add displacement and upset the balance of everything.

The Naval Defence Act also included a certain number of third-class cruisers—*Pallas*, *Pearl*, *Philomel*, and *Phœbe*—for the ordinary service, and five similar ships for the Australian station, originally named *Pandora*, *Pelorus*, *Persian*, *Phœnix*, and *Psyche*. These were later altered to Australian names, *Katoomba*, *Mildura*, *Wallaroo*, *Tauranga*, and *Ringarooma*. They were of 2,575 tons, with 2½ decks, armaments of eight 4.7-inch and four above-water 14-inch tubes. The designed speed was 19 knots.

Thirteen torpedo gunboats, improved *Rattlesnakes*, were laid down under the Act, corresponding to nine others of the normal Programme, of which two were for Australia. The Naval Defence boats were *Alarm*, *Antelope*, *Circe*, *Gleaner*, *Gossamer*, *Hebe*, *Renard*, *Speedy*—all laid down in 1889, as also were the *Whiting* (afterwards *Boomerang*) and *Wizard* (renamed *Karahatta*) for Australia. Those laid down normally in the previous year were the *Salamander*, *Seagull*, *Sheldrake*, *Skipjack*, *Spanker*, *Speedwell*, for the British Navy. Two others, *Assaye* and *Plassy*, were built for the Indian Marine at and about this time. All carried a couple of 4.7-inch guns, were of about 750-850 tons displacement, and were first known as "catchers." They were all intended to steam at 19 knots or over with locomotive boilers; but in service none ever did. At a later date, reboilered with water-tubes, many reached or exceeded the designed speed, and the majority of them are still in service for auxiliary purposes—many being specially fitted as mine sweepers, and the rest used as tenders for various services.

They are of considerable interest on account of the fact that the destroyers of 1909-12 were practically the same displacement and general shape, with a not very dissimilar armament—two 4-inch instead of two 4.7. The modern destroyers, however, were approximately ten knots faster—an interesting commentary on engineering improvements in the course of twenty years!

More interesting still, however, is the fact that Sir William White should have evolved twenty years ago almost exactly what—except in the matter of modern speed possibilities—is to-day the recognised ideal for destroyers.

In the British Navy the torpedo gun-boats never get beyond the "catcher" stage—they never had the opportunity; but it is worthy of note that the first two ships to be torpedoed under anything like modern war conditions—the Chilian *Blanco Encalada* and the Brazilian *Aquidaban*—were both sunk by vessels of almost exactly the same type as the "catchers," and not by torpedo boats.

So far as the British Navy was concerned, the "catchers" tested in the "secret manœuvres" of 1891 did uncommonly well. They hung about off the torpedo bases, and though only about one to four, accounted for at least 90 per cent. of the hostile torpedo boats. To this very success, perhaps, was due the fact that in their own day they were not thought of as an offensive arm against big ships—destruction of the torpedo boat was then the principal aim in view. This they fulfilled. The South American Republics discovered their "other uses," and so really led the way to the evolution of the destroyer of a later era.

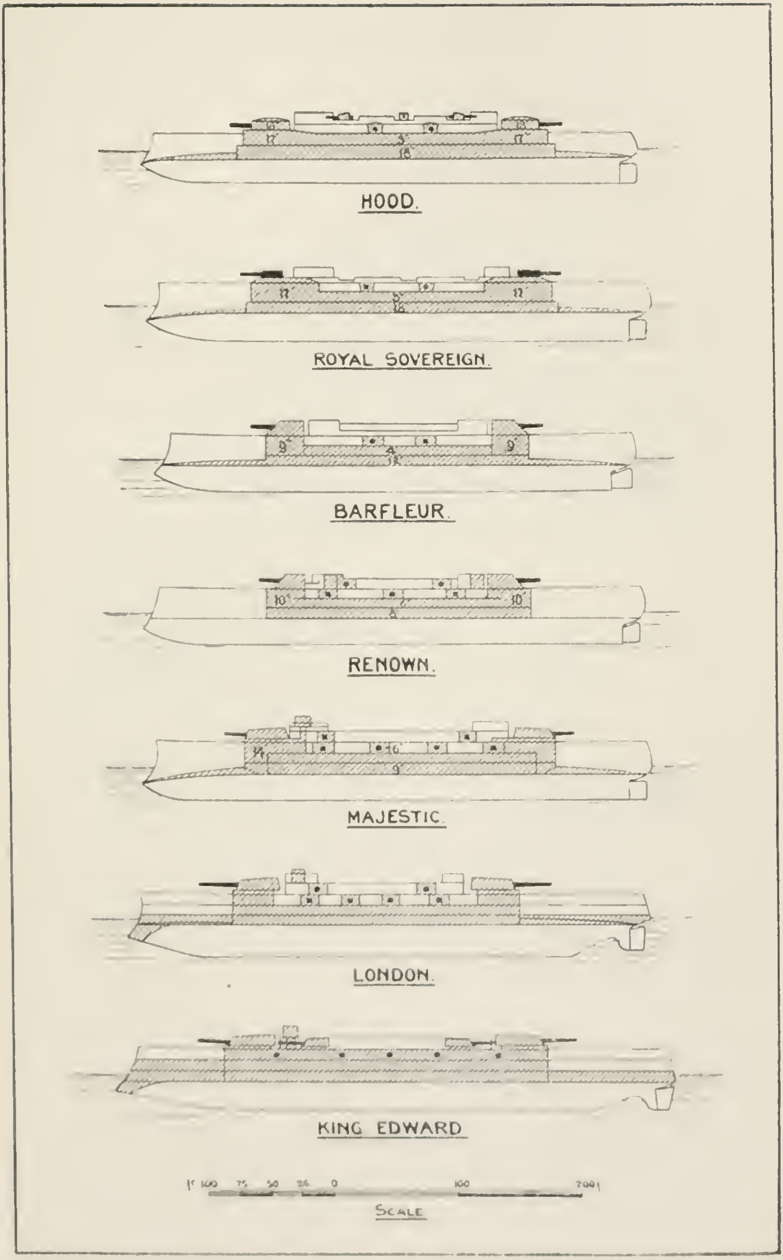
Perhaps the only nation which really read the lesson involved was Germany. So long ago as 1895 she had launched the 2,000-ton "small cruiser" *Hela*; in 1898 the *Gazelle* of 2,645 tons was set afloat. For years Germany added to the *Gazelle* class, at a time when all the rest of the world had decreed that "third-class cruisers" were useless. Not for many a year did the British Admiralty discover that Germany had seen the matter of the *Lynch* and the *Sampaio** better than any other Power.

Neither of these ships in attacking got hit. They got home without. But they might have been hit. Germany evolved something that even if hit badly would still float long enough to get off her torpedoes.

Till the Chilian "catchers" in 1891 proved their offensive abilities, no one had ever considered that side of the question. To this day Germany has never really received her meed of credit for perceiving that a small third-class cruiser has potentialities with torpedoes against a battleship at night.

So late as the present day much comment about German small cruisers being inadequately gunned,

* The *Lynch* and *Condell* (launched 1890) sank the Chilian *Blanco Encalada* in 1891; the *G. Sampaio* (1893) the Brazilian *Aquidaban* in 1894.



BATTLESHIPS OF THE WHITE ERA.

a clear indication that just as in the past there was a difficulty in conceiving of the torpedo-gunboat for other than her nominal use, so the possibilities of the small cruiser in the role of destroyer were still apt to be generally overlooked.

In February, 1893, there was laid down the *Renown*, the only armoured ship of the 1892-93 Estimates; an improved *Centurion*, with thinner belt armour. Harvey armour—three inches of which had the resisting value of four inches of compound or six inches of iron—was adopted in this ship for the first time. Influences other than taking advantage of the reduced weight required for a given protective value were, however, at work, for in the *Renown* sacrifices were made at the waterline in order to secure better protection to the lower deck side.

Details of the *Renown*:—

Displacement—12,350 tons.

Length (between perpendiculars)—380ft.

Beam—72½ft.

Draught—(maximum) 27ft.

Armament—Four 10-inch, ten 6-inch 40 cal., twelve 12-pounders, four submerged 18-inch tubes, and one above water-line in stern.

Armour—8-6in. belt, 200ft. long amidships, 6in. side above. Bulkheads 10-6in., barbettes 10in., casemates, main deck ones 6in., upper deck ones, 4in.

Horse-power—12,000 = 18 knots.

Coal—(normal) 800 tons; (maximum) 1,760 tons = nominal 7,200 miles at ten knots.

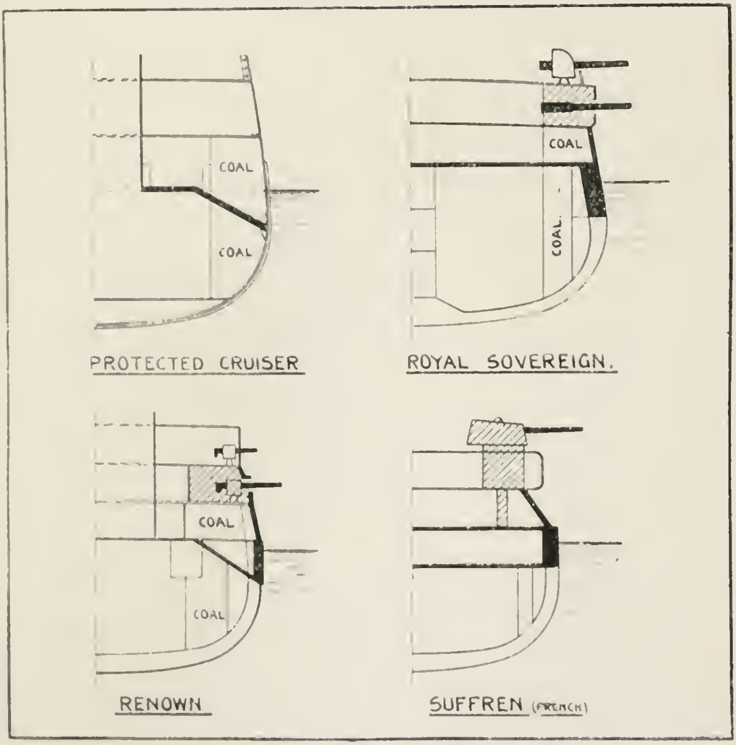
Built at Pembroke; engined by Maudslay; she was launched in May, 1895, and completed for sea in

April, 1897, having taken no less than $4\frac{1}{4}$ years to build. Cost, £746,247.

She proved one of the best steamers ever built for the Navy. On a four-hour trial she made 18.75 knots, with 12,901 I.H.P. Her economical speed proved to be fifteen knots. She always steamed well, and after thirteen years' service did 17.4 knots with ease.

The special feature of this ship was that in her instead of the ordinary flat deck on top of the belt, a sloping deck behind the belt was first introduced. This system—rigidly adhered to in the British Navy ever since, and copied eventually into every other Navy—was based upon the idea of reinforcing the deck-protected cruiser with side armour. The principle involved was that at whatever angle the belt might be hit and penetrated, the incoming projectile would then meet a further obstruction at a 45° angle, calculated to present a maximum of deflecting resistance. Professor Hovgaard and others have since indicated that, weight for weight, three inches of inclined deck armour, having to be spread more, represent as much or more tons as six inches of vertical armour (the nominal equivalent), and protective decks behind armour are to-day much thinner than of yore and little better than "splinter decks." The principle, however, remains, as originated by Sir William White, and is, perhaps, the most characteristic feature of his era: seeing how universally the idea was copied.

The French were the last to adopt it. Instead, they used the flat deck below the belt in addition to the one on top of it. This was made use of so late as the *République* and *Liberté* class. While ideally better for



SYSTEMS OF WATER-LINE PROTECTION

resisting projectiles which might penetrate the belt, it was impossible of really practical application amidships on account of the difficulty of keeping the engines entirely below it.

The *Renown* was the first ship to carry all her secondary guns in casemates. She was fitted as a flagship, and first served on the North American Station. When Admiral Fisher went from there to the Mediterranean he took the *Renown* with him as flagship, presumably with the idea that speed was better than power in a flagship. The *Renown's* fighting power was small even then, but she was well fitted for the social side of flagship work—so nicely, indeed, that the flash-plates of the big guns had been taken up so as not to interfere with ladies' shoes in dances!

After leaving the Mediterranean the *Renown* was still further converted into a "battleship yacht," the six-inch guns being removed. She was painted white, and used to convey the then Prince of Wales to India. Thereafter she practically disappeared from the effective list and eventually became a training ship for stokers.

The *Renown* was followed by the ships of the Spencer programme, nine battleships of the *Majestic* class, which were spread over the 1893-94 Estimates, and those of the next year. The *Majestics* were in substance amplified *Renowns*, their special and particular feature being that in place of the two amidships belt of varying thickness a single belt of 16ft. wide of a uniform 9in. thickness was substituted.

In the *Majestics*, the 13.5, which had been for so long the standard gun for first-class battleships, disappeared in favour of a new type of 12-inch, a Mark VIII. of 35 calibres. The two types compare as follows :—

Bore. Inch.	Length. Cals.	Weight. Tons.	Projectile. lbs.	Maximum Penetration against K.C. (capped projectiles). at 5000 yds. in.	at 3000 yds. in.
13.5	30	67	1250	9	12
12	35	46	850	11½	14½

The new gun was, therefore, superior in everything except weight of projectile, and that was not considered much in those days. To-day, of course, it has quite a special meaning.

In the *Majestics*, except in the first two, all-round loading positions for the big guns were introduced in place of the cumbersome old system whereby, after firing, the guns had to return to an end-on position, tilt up, and at a fixed angle take their charges at what was little but an adaption for breechloaders of the loading system evolved twenty years before for the old *Inflexible.*

Details of these ships :—

Displacement—14,900 tons.

Length—(between perpendiculars) 390ft., (over-all) 413ft.

Beam—75ft.

Draught—(mean), 27½ft., (maximum) about 30ft.

Armament—Four 12-inch 35 cal., twelve 6-inch 40 cal., sixteen 12-pounders, twelve 3-pounders. Torpedo tubes (18-inch), four submerged and one above water in stern.

Armour (Harvey)—Belt, (220ft. by 16ft.) 9in. Bulkheads, 14in. Barbettes, 14in. with 10in. turrets. Casemates, 6in.

Horse-power—12,000=17.5 knots.

Coal—(normal) 1,200 tons ; (maximum) 2,200 tons =nominal radius of 7,600 miles at 10 knots and 4,000 at 15 knots.

The ships were built, etc., as follows :—

Name.	Laid down.	Builder.	Engined by
Magnificent	Dec. '93	Chatham	Penn
Majestic	Feb. '94	Portsmouth	Vickers
Hannibal	April, '94	Pembroke	Harland & Wolff
Victorious	May, '94	Chatham	Hawthorn, Leslie
Mars	June, '94	Laird	Laird
Prince George	Sept. '94	Portsmouth	Humphrys
Jupiter	Oct. '94	Clydebank	Clydebank
Cæsar	March, '95	Portsmouth	Maudslay
Illustrious	March, '95	Chatham	Penn

Mostly they were completed inside two years, the only ones which took appreciably longer being the *Hannibal* and the *Illustrious*. In these and the *Cæsar* an innovation introduced in the others—the placing of the chart house round the base of the foremast with the conning tower well clear ahead—was done away with, and the old system of the bridge over the conning tower reverted to. In the *Cæsar* and *Illustrious*, laid down later than the others, an improvement was effected by the introduction of circular instead of pear-shaped barbettes. The *Majestic*, *Magnificent*, and *Cæsar* were built in dry dock instead of on slips—the first instance of this since the days of early coast-defence monitors.

The total cost was approximately a million per ship.

On trials most of them exceeded the designed speed, but all were light on trials. They proved very handy ships, with circles of 450 yards at fifteen knots. Coal consumption was always high.

Compared to the *Sovereigns*, the following figures are of interest :—

Name.	Displacement (tons).	Weight of Armour (tons).	Weight of Armament & Ammunition (tons).	H.P.	Normal Coal (tons).
Majestics........	14,900	4260	1500	12,000	1200
Sovereigns	14,100	4600	1410	13,000	900

The total dead weight carried in armament, armour, and coal thus works out at practically the same figure, despite the rise of 800 tons in displacement. On these grounds certain attacks were made upon the ships, mainly by those who argued against the unarmoured ends. The criticisms were, however, mainly of the captious order—the ships were certainly the finest specimens of naval architecture of their day.

At a later date electric hoists were fitted to the 6-inch guns, and 400 tons of oil fuel were added to the fuel capacity (the maximum coal capacity being reduced by 200 tons). The first ship to be so fitted was the *Mars.* Another innovation was shifting the torpedo nets, first in the *Mars*, then in all the others, from the upper deck to the main deck level ; the idea being to keep the nets clear of the 6-inch guns.

The *Majestic* and *Magnificent* served for a long time as flagships in the Channel Fleet. Admiral Sir F. Stephenson and Sir A. K. Wilson flew their flags in the *Majestic*, of which ship Prince Louis of Battenberg was at one time captain.

It was during the early service of the *Majestics* in the Channel Fleet that " invisible " colours for warships first came into consideration, all ships up to that date being painted with black hulls, white upper works, and yellow masts and funnels. For these experiments the *Magnificent* was painted black all over, the *Majestic* and *Hannibal* were given grey and light green upper works respectively. The latter was really the more "invisible" of the two, but both ships were left with black hulls. Ultimately a grey, a little darker than that which the Germans had long used, was adopted as the regulation, though for some time it varied greatly between ship and ship, following the old system under which a good deal of latitude in painting was allowed.*

To this era, 1894-95, belong two groups of protected cruisers, the *Powerfuls* and the *Talbots.* The latter, nine in all, were merely enlarged (5,600 tons) editions of the later cruisers of the Naval Defence Act, and call for no comment. The former group were the *Powerful* and *Terrible*, "replies" to the Russian *Rurik* and *Rossiya.* They displaced nearly as much as the battleships—14,200 tons—and ran to the then unheard of length of 500ft. between perpendiculars. They carried no belt armour whatever, but were given stout protective decks, no less than 6in. on the slopes amidships. The two big guns (40 calibre, 9.2) were given 6in. Harvey barbettes, the twelve other guns† (6-inch) being in 6-inch casemates. Sixteen 12-pounders were disposed about the upper works. Designed horse-power 25,000=22 knots. Total bunker capacity of 3,000 tons, equal to a nominal 7,000 miles at fourteen knots. Both ships were laid down in 1894, the *Powerful* by Vickers and the *Terrible* at Clydebank. They were launched in the following year.

* In 1894 the *Thunderer* had her upper works painted in black and white chequers, like the old three-deckers of the Nelson era. Ships with the top of their upper works yellow were also not uncommon.

† About 1902-3 four additional casemates for 6-inch guns were added on top of the four amidship casemates.

In service the *Powerfuls* proved capable of keeping up a speed of twenty knots almost indefinitely. For the rest, they were unhandy ships with large turning circles. At the time of the South African War, both of them were at the Cape, and did service with landed naval brigades. Of these, one from the *Powerful*, with some 4.7's on special Percy Scott gun-carriages, materially assisted in the defence of Ladysmith.

During the year 1911 the decision was come to that it was not worth while preserving either ship, on account of the large crews required and their comparatively small fighting value under modern conditions.

Two considerable novelties were embodied in these ships. The first of these was the adoption of electrical gear for the big guns. The other and more far-reaching was the adoption of Belleville boilers.

THE BATTLE OF THE BOILERS.

Owing to favourable reports of their use in the French Navy, Belleville boilers were in 1895 experimentally fitted to the *Sharpshooter*, torpedo gunboat; but the decision to adopt them in large ships was taken from French rather than any British experience. Trouble and failure were freely predicted. With the result frequently attending lugubrious predictions, very little trouble has ever been experienced with any type and then only in the very early stage when the water-tube boiler was an almost unknown curiosity to the engine-room staff.

The chief advantages claimed for Belleville boilers were the higher working pressures, economy in maintenance and fuel consumption, saving of weight, rapid steam raising, and great facility for repairs.

The Belleville was the first water-tube boiler to

WHITE ERA BATTLESHIPS OF THE MAJESTIC CLASS

come into prominence; other types, however, soon appeared. In the period 1895-98, torpedo gunboats were experimentally fitted as follows:—*Sharpshooter*, Belleville; *Sheldrake*, Babcock; *Seagull*, Niclausse; *Spanker*, Du Temple; *Salamander*, Mumford; *Speedy*, Thornycroft—these three last being of the small tube type. Other existing types were the Yarrow, White-Foster, Normand, Reed, Blechynden, all these being of the small tube type also, and regarded as suitable for small craft only.*

In the matter of big ships, so far as the British Navy was concerned, "water-tube boiler" for some years meant Bellevilles only, whence it came that in the insensate "Battle of the Boilers," which presently broke out, Bellevilles were the main object of attack in Parliament and elsewhere. Actually, of course, the whole principle was in the melting pot. All the elements opposed to change in any form rallied to the attack, led on and influenced in some cases by those whose interests were bound up with the old style cylindrical boilers. It was all over again the old story of the fight for the retention of the paddle against the screw propeller, with an equal disregard for facts.

Unfortunately the party of progress played somewhat into the hands of the reactionaries. In fitting the Belleville type only, they had not much alternative, other types being then in a less forward state. The error made was that in the wholesale adoption of a new type of steam generator, requiring twice the skill and intelligence necessary for the old type, it was practically impossible to train quickly enough a sufficiency of engineers and stokers. Hence troubles soon arose. An even greater

* The large tube Yarrow, now so general, did not appear till at a later date.

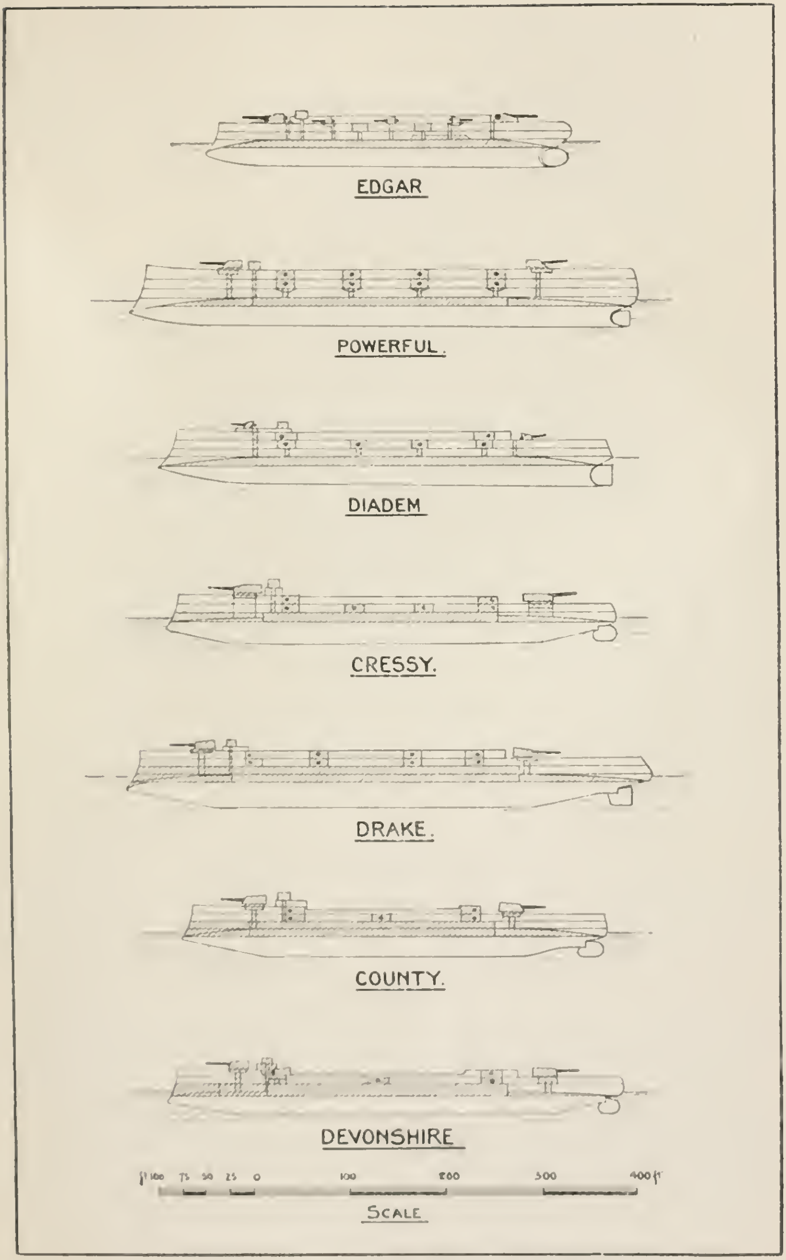
error was that the boilers were mostly built in England to the French specifications, without, in many cases, sufficient experienced supervision ; and minor " improvements," such as fusible plugs and restricting regulations, were introduced by more or less amateur Admiralty authorities—which also produced trouble.

For example, French practice had taught that adding lime to the feed water was desirable ; but in many British ships this rule was ignored. Again, one Belleville essential was to throw on coal in very small quantities at a time, in contradistinction to the old cylindrical practice in which shovelling on enormous quantities of coal was the recipe for increased speed. This feature was often disregarded.

The Belleville, ever a complicated and delicate mechanism, if its full efficiency is to be secured, was a worse boiler for the experiments than many of the simpler types of to-day would have been. But no water-tube boiler of any type would have stood any chance of success against the opposition. There were some terrible times in the boiler rooms in those days. One or two ships whose chief engineers had been specially trained in France secured marvellous results, usually by ignoring Admiralty improvements and regulations.* But for one success there were many early failures.

The agitation triumphed to the extent of a Committee of Inquiry being appointed. An interim report of this Committee made a scape-goat of the Belleville,

* Comparatively recently a ship—best left unnamed—made wonderful speed. With a new Engineer Commander she suddenly lost 25 per cent. of her horse-power. The newcomer was rather inexperienced in the type, and closely followed Admiralty regulations. Presently the ship recovered her power—he had given up following the book ! It is only fair to say that the restrictive regulations of the Admiralty were mostly forced upon them by people ashore, who probably had not even a nodding acquaintance with the engine-room of a warship, or warship requirements.



PRINCIPAL CRUISERS OF THE WHITE ERA.

to the extent of recommending that no more should be fitted. But the victory of the retrogrades ended there. A species of compromise with public opinion inflamed against the water-tube system was temporarily adopted, and absurd mixed installations of cylindrical and water-tube boilers were fitted to some ships. Four large tube types were selected as substitutes for Bellevilles, the Niclausse, Dürr (a German variant of the Niclausse), the Babcock and Wilcox, and the Yarrow large tube.

It may approximately be said that every water-tube boiler is a species of compromise between facility for rapid repair on board ship and complication, and the need of great care in using and working. It is usual to put the Belleville at one end of this scale and the Yarrow (large tube) at the other, this last boiler now requiring little, if any, more care than the old type of cylindrical.

In the course of comparatively short experiments, both the Niclausse and the Dürr were found to possess most of the alleged deficiencies of the Belleville without its advantages ; and it was decided to fit all future types of large ships with the Babcock and Yarrow types only. The absurd mixture of cylindrical and water-tube boilers was wisely done away with. Curiously enough, the Belleville boiler, once the agitation had ceased, also ceased to be troublesome. This was no doubt due to the increased experience which had been gained in the interim.

Both the Babcock and Yarrow boilers have been immensely improved since the days when they were first brought out. Something of the same sort is, of course, true of all the standard types, and there is to-day hardly any question as to which of them may be the best or worst. Each type has some special advantage of its own, and in no case, probably, is that advantage sufficiently pronounced to render any one type absolutely the best. When adopted by the Admiralty the Belleville was certainly the best water-tube boiler available. Had it been persisted in and not " improved " by amateurs it would probably have done quite as well as any type adopted to-day. The real issue was mainly not one of type, but of principle. That principle was the water-tube boiler as opposed to the old type cylindrical.

The Estimates for 1896-97 provided for five battleships which were somewhat sarcastically alluded to as " improved " *Majestics.* These ships were the *Canopus* class, and they mark a species of early striving after the ideal of the battle-cruisers of to-day. That is to say, certain sacrifices were made in them with a view to securing increased speed.

Particulars of these ships :—

Displacement—12,950 tons.
Length—(over all) 418ft.
Beam—74ft.
Draught—(maximum) 26½ft.
Armament—Four 12in., 35 cal., twelve 6in. 40 cal., ten 12-pounders, four submerged tubes (18in.)
Armour—Harvey-Nickel. Belt amidships 6in. with 2in. extension to the bow and 1½in. skin aft on the waterline. Bulkheads and barbettes 12in. Turrets 8in.
Horse-power—31,500=18.25 knots.
Coal—(normal) 1,000 tons ; (maximum) 2,300 tons =nominal radius of 8,000 miles at 10 knots.

The adoption of Harvey-Nickel armour, which was of superior resisting power to Harvey armour in the ratio of about 5 to 4, partly, but not entirely accounted for the thinning of the armour of this class. Theoretically, the 9in. armour belt of the *Majestic* was equal to 18in. of iron, while the belt of the *Canopus* class was equal to about 15in. of iron. In place of the 4in. deck of the *Majestics*, the *Canopus* class had only a 2½in. deck. The thin bow (2in.) plating was introduced as a sop to a public agitation against soft-ended ships. Such a belt is, of course, perfectly useless against any heavy projectile, or, for that matter, against 6in., except at very long range indeed. Sir William White never made any secret of his cynical disbelief in these bow belts. They were and always have been what doctors call a "placebo."

In the following year the sixth ship of this class was built—the *Vengeance*. She differed from the others in the form of her turrets, which were flat sided for the first time. In her also a mounting was first introduced, whereby, in addition to being loaded in any position, big guns could also be loaded at any elevation.

Some other details of the *Canopus* class are :—

Name.	Built by	Engines by	Laid down.	Completed.
Canopus	Portsmouth	Greenock	Jan. '97	1900
Goliath......	Chatham	Penn	Jan. '97	1900
Albion	Thames I.W.	Maudslay	Dec. '96	1902
Ocean.......	Devonport	Hawthorn Leslie	Feb. '97	1900
Glory	Laird	Laird	Dec. '96	1901
Vengeance ..	Vickers	Vickers	Aug. '97	1901

The cruisers of the following year were eight cruisers of the much discussed *Diadem* class, small editions of the *Powerful* (11,000 tons), and carrying a pair of 6-inch guns in place of the 9.2's of the *Powerfuls*. For the first four (the *Diadem*, *Andromeda*, *Europa*, and *Niobe*) a speed of 20.5 knots only was provided, but in the late four (the *Argonaut*, *Ariadne*, *Amphitrite*, and *Spartiate*) the horse-power was increased to 18,000, in order to provide twenty-one knots. At the present time (1912) these ships have for all practical purposes already passed from the effective list, all the weak points of the *Powerfuls* being exaggerated in them.

In the Estimates for the years 1895 to 1898, provision was made also for eleven small third-class cruisers of the "P" class of 2135 tons and twenty knot speed. The armament consisted of eight 4-inch guns. On trials most of them did well, but in a very short time their speeds fell off, and at the present time, such of them as remain on the active list are slower than the far older cruisers of the *Apollo* class.

In the Estimates for 1897-98, in addition to the *Vengeance*, already mentioned, three improved copies of the *Majestic* were provided. These ships were :—

Name.	Laid down.	Built at.	Engines by.
Formidable	March, '98	Portsmouth	Earle
Irresistible	April, '98	Chatham	Maudslay
Implacable	July, '98	Devonport	Laird

The only difference between them and the *Majestics* lies in advantage being taken of improvements in gunnery and armour to increase the offensive and defensive items. The absurd 2-inch bow belt of the *Canopus* was repeated in them, but raised within 2½ft. of the main deck. A 40-calibre 12-inch was mounted, also a 45-calibre 6-inch.

These were the first ships of the British Navy in which Krupp cemented armour was used. This armour, generally known as "K.C.," has approximately a resisting power three times that of iron armour. That is to say, the 9in. belts of the *Formidables* were approximately 33 per cent. more effective than the similar belts of the

Majestics. These ships proved faster and more handy, easily exceeding their designed eighteen knots. The superior handiness was brought about by a superior form of hull—the deadwood aft being cut away for the first time in them.

In this year's Estimates armoured cruisers definitely re-appeared, six ships of the *Cressy* type being laid down.

Particulars of these :—

Displacement—12,000 tons.

Length—454ft.

Beam—69½ft.

Draught—(maximum) 28ft.

Armament—Two 9.2, 40 cal., twelve 6-inch, 45 cal., twelve 12-pounders, two 18in. submerged tubes.

Armour—6in. Krupp belt amidships, 250ft. long by 11½ft. wide, 2in. continuation to the bow. Barbettes 6in. Casemates 5in.

Horse power—21,000=21 knots.

Coal—(normal) 800 tons ; (maximum) 1,600 tons.

Name.	Laid down.	Built at.	Engined by.
Sutlej	Aug. '98	Clydebank	Clydebank
Cressy	Oct. '98	Fairfield	Fairfield
Aboukir . ..	Nov. '98	Fairfield	Fairfield
Hogue	July, '98	Vickers	Vickers
Bacchante	Dec. '99	Clydebank	Clydebank
Euryalus	July, '99	Vickers	Vickers

In substance these ships were armoured editions of the *Powerful.* They steamed very well in their time, but have now fallen off considerably and are no longer of any importance. Total weight of armour 2,100 tons. An innovation introduced in these ships was the fitting of non-flammable wood, which at a later date was objected to on the grounds that it deteriorated the gold lace of the uniforms stored in drawers made of it. The *Cressy* was completed in 1901; the others, excepting the *Euryalus*, in 1902. This latter ship was greatly delayed from various causes, and not completed until 1903.

The 1898-99 Estimates consisted of three battleships and four armoured cruisers. The battleships were practically sisters to the *Formidable*, but differed from her in that the main belt, instead of being a patch amidships, has a total length of 300ft. from the bow. At the bow it is 2in., quickly increasing to 4in., 5in., 6in., and finally to 9in., and this provided a measure of protection that the 2in. belts of preceding ships could never afford. The flat-sided turrets, first introduced in the *Vengeance*, were also fitted in these ships, the *Formidables* having the old pattern turrets.

The advantages of flat-sided turrets lie in the fact that K.C. can be used for them instead of the relatively softer non-cemented. K.C. is not applicable to curved surfaces, for which reason barbettes, casemates, and batteries with curved portholes in them and rounded turrets cannot be constructed of it. Flat-sided turrets consist of a number of flat plates placed to meet each other at predetermined angles, thus forming one homogeneous whole.

These battleships were :—

Name.	Laid down.	Built at	Engines by.
London	Dec. '98	Portsmouth	Earle
Bulwark	March, '99	Devonport	Hawthorn
Venerable	Nov. '99	Chatham	Maudslay

All were completed in 1902.

The cruisers of the same year, the *Drake* class, were "improved" *Cressies*, with increased displacement, power and speed. The increased displacement allowed of four extra 6-inch guns being mounted, these being placed in casemates on top of the amidships casemates.

Particulars of the *Drake* class :—

Displacement—14,000 tons.

Length—(over all) 529½ft.

Beam—71ft.

Draught—(maximum) 28ft.

Armament—Two 9.2, 45 cal. (instead of 40 cal., as in the *Cressies*), sixteen 6-inch, 45 cal., and fourteen 12-pounders, two submerged tubes (18in.).

Armour—2,700 tons, as in *Cressy*, except that the casemates are 6in. thick.

Horse-power—30,000 = 23 knots. Boilers, 43 Belleville.

Coal—(normal) 1,250 tons ; (maximum) 2,500.

These ships were altogether superior to the *Cressy* class. On trial they all easily made their contract speeds and subsequently greatly exceeded them. It was discovered that increased speed was to be obtained by additional weight aft, and this was so much brought to a fine art that weights were adjusted accordingly, and in one of them, seeking to make a speed record, the entire crew were once mustered aft in order to vary the trim !

Building details are as follows :—

Name.	Laid down.	Completed	Built at.	Engines by.
Good Hope	Sept. '99	1902	Fairfield	Fairfield
Drake	April, '99	1902	Pembroke	Humphrys & T.
Leviathan	Nov. '99	1903	Clydebank	Clydebank
King Alfred ...	Aug. '99	1903	Vickers	Vickers

For some years these were the fastest ships in the world. In 1905, in a race by the Second Cruiser Squadron across the Atlantic, with ships of nominally equal speed, the *Drake* came in first. In December, 1906, at four-fifths power for thirty hours, she averaged 22.5 knots. In 1907, the *King Alfred* averaged 25.1 knots for one hour, and made an eight hours' mean of 24.8. They proved very economical steamers, being able to do nineteen knots at an expenditure of eleven tons of coal an hour, and though they are now getting old, as warships go, they have never yet been beaten on the results achieved by horse-power per ton of displacement.

The Estimates of 1898-99 included a supplementary programme of four armoured ships which, like the *Canopus* class, again foreshadowed the battle cruisers of to-day. These were the famous *Duncan* class, and may be described as slightly smaller editions of the *London*, with armour thickness sacrificed for superior speed. The belt amidships was reduced from 9in. to 7in., but against this the belt at the extreme bow was made an inch thicker, and 25ft. away from the ram became 5in. thick. The displacement sank by 1,000 tons, the horse-power was increased by 3,000, and the speed by one knot.

The total weight of armour is about 3,500 against 4,300 tons in the *Londons*. The *Duncans* may be regarded as a species of recrudescence of Barnaby ideas, plus a later notion that a well-extended partial protection was better than a more concentrated protection of less area. Generally speaking, they were improved duplicates of the *Canopus* class, in the same way that the *Formidable* and the ships that followed her were duplicates of the *Majestic*. Two ideas were obviously at work. In other forms these two ideas have (with variations) existed to the present day. Then it was purely a question between ratios devoted to speed and protection. To-day (1912) matters have been so far modified that increased displacements are given to secure speed advantages, but protection remains proportionately as it was. Reduced armament has always been accepted.

Construction details of the *Duncans*, of which two more figured in the estimates for 1899-1900 :—

Name.	Laid down.	Built at.	Engines by.
Duncan	July, '99	Thames, I.W.	Thames, I.W.
Russell	March, '99	Palmer	Palmer
Cornwallis	July, '99	Thames, I.W.	Thames, I.W.
Exmouth	Aug. '99	Laird	Laird
Albemarle	Jan. '00	Chatham	Thames, I.W.
Montagu	Nov. '99	Devonport	Laird

The *Montagu* was wrecked on Lundy Island in 1906.

Contemporaneous with the *Drakes*, and extending over four ships in the Estimates of 1898-99 to two in the following and four in the year later, ten armoured cruisers were provided for, which in essence were little but an attempt to provide a normal second-class protected cruiser of the *Talbot* class, with armour protection. These ships—the *County* class—are of 9,800 tons displacement, and may also be regarded as diminutives of the *Drake* and *Cressy* classes, with a touch of the *Diadems* thrown in. In place of the fore and aft 9.2's of the *Drake* and *Cressy*, they were supplied with a couple of pairs of 6-inch guns mounted in turrets fore and aft. The belt amidships was reduced to 4in. (a thickness in K.C. which has no virtues over armour of earlier type) with the usual extension of 2in. to the bow. The twin turrets, in which, like those of the *Powerful*, electrical control was once more introduced, have never given satisfaction, being very cramped for working purposes, and probably no more efficient than single gun turrets would have been, certainly less than the single gun 7·5in. turrets, originally proposed as an alternative, would have been.

Had the ships been regarded frankly as modern variants of the second-class protected cruisers, they probably would have been esteemed more than they were. Unfortunately they have always been regarded as "armoured ships" and discounted on account of their obvious inferiority to the *Drakes.* In the matter of steaming all of them have invariably done well (except in the case of the *Essex*, over which a mistake in design was made). The anticipated twenty-three knots was made quite easily, once certain early propeller difficulties were overcome. The Boiler Commission, already referred to, affected these ships, in so far that, instead of the hitherto inevitable Bellevilles, the *Berwick* and *Suffolk* were given Niclausse boilers and the *Cornwall* Babcocks. The total weight of armour is 1,800 tons.

Details of the construction of this class are :—

Name.	Laid down.	Built at.	Engines by.
Essex	Jan. '00	Pembroke	Clydebank
Kent	Feb. '00	Portsmouth	Hawthorn
Bedford	Feb. '00	Fairfield	Fairfield
Monmouth	Aug. '99	L. & Glasgow	L. & Glasgow
Lancaster	Mar. '01	Elswick	Hawthorn L.
Berwick	April, '01	Beardmore	Humphrys
Donegal	Feb. '01	Fairfield	Fairfield
Cornwall	Mar. '01	Pembroke	Hawthorn
Cumberland	Feb. '01	L. & Glasgow	L. & Glasgow
Suffolk.................	Mar. '02	Portsmouth	Humphrys & T.

All were completed during 1903 and 1904.

For the year 1900-01 only two battleships were provided: the *Queen*, built at Devonport and engined by Harland and Wolff, and the *Prince of Wales*, built at Chatham and engined by the Greenock Foundry Co. These were laid down in 1901 and completed in 1904. They were copies of the *Londons* in every detail, saving that, instead of being enclosed, their upper deck batteries were left open as in the *Duncans*. The *Queen* was given Babcock boilers instead of Bellevilles.

The 1901-02 Estimates provided three battleships and six armoured cruisers of the *County* class. These were the last ships designed by Sir William White. The battleships, of which eight were built altogether—three for 1901-02, two for the next year—were of a different type from any which had preceded them, and to some extent may be said to mark the birth of the *Dreadnought* era. That is to say, in them the old idea of the two calibres, 12in. and 6in., died out, and heavier auxiliary guns began to appear.

Particulars of these ships, the *King Edward VII* class, are as follows:—

Displacement—16,350 tons.

Length—(over all) 453¾ft.

Beam—78ft.

Draught—(maximum) 26¾ft.

Armament—Four 12-inch, 40 cal., four 9.2, 45 cal., ten 6-inch, 45 cal., twelve 12-pounders, fourteen 3-pounders, five 18-inch submerged tubes (of which one is in the stern).

Armour—As in the *London* (but a 6in. battery instead of casemates).

Horse-power—18,000=18.9 knots.

Coal—(normal) 950 tons; (maximum) 2,150 tons, also 400 tons of oil, except in the *New Zealand*.

Name.	Laid down.	Built at.	Engines by.
Commonwealth	June, '01	Fairfield	Fairfield
King Edward	Mar. '02	Devonport	Harland & W.
Dominion	May, '02	Vickers	Vickers
Hindustan	Oct. '02	Clydebank	Clydebank
New Zealand (now *Zelandia*)	Feb. '03	Portsmouth	Humphrys & T.
Africa	Jan. '04	Chatham	Clydebank
Britannia	Feb. '04	Portsmouth	Humphrys & T.
Hibernia	Jan. '04	Devonport	Harland & W.

Except the last three, all were completed in 1905. The others were completed very shortly afterwards.

The boilers fitted to these ships varied considerably. The *King Edward*, *Hindustan*, and *Britannia* were given a mixed installation of Babcocks and cylindricals; the *New Zealand* Niclausse boilers; the other ships Babcock only. In the *Britannia*, super-heaters were also fitted to six of her boilers. The point differentiating these ships from their predecessors was the mounting of four 9.2 guns in single turrets at the angles of the superstructure. Equally novel was the placing of 6-inch guns in a battery behind the armour on the main deck.* Fighting tops, a feature of all previous ships, disappeared, and in place of them fire-control platforms were substituted.

When produced, these ships were considered as something like the "last word"; but in service later on it was very soon found that the two calibres of big guns rendered fire-control extremely difficult, and they have been a somewhat costly lesson in that respect. They cost about £1,500,000 each, and were found to be all that could be desired tactically, their turning circles with engines being only about 340yds. at fifteen knots. All of them did not make their speeds on trials, and some have never quite come up to expectations in that

* This idea was borrowed from the Continent. Germany had long adopted batteries, and nearly every other nation had followed suit.

respect, but they have all proved remarkably reliable steamers.

Six armoured cruisers provided for in the 1901-02 Estimates were the *Devonshires*. These were originally intended to have been enlarged *Counties*, carrying a single 7.5 fore and aft, in place of the twin 6-inch turrets of the prototype ships. The design was, however, modified to the extent of substituting a single 7.5 for each of the forward pairs of 6-inch casemates.

Details of these ships are :—

Displacement—10,850 tons.

Length (between perpendiculars)—450ft.

Beam—68½ft.

Draught—(maximum) 25½ft.

Armament—Four 7.5, six 6-inch, 45 cal.; two 12-pounders, twenty-two 3-pounders, two 18in. torpedo tubes submerged.

Armour Belt—(length 325ft. from the bow, width 10½ft.), 6in. amidships, thinning to 2in. right forward. Barbettes 6in. Turrets 5in. Casemates 6in.

Horse-power—21,000=22.5 knots.

Coal—(normal) 800; (maximum) 1,800 tons.

Other details are :—

Name.	Laid down.	Built at.	Engined by.
Devonshire	Mar. '02	Chatham	Thames I.W.
Antrim	Aug. '02	Clydebank	Clydebank
Argyll	Sept. '02	Greenock Foundry	Greenock F.C.
Carnarvon	Oct. '02	Beardmore	Beardmore
Hampshire	Sept. '02	Elswick	Elswick
Roxburgh	June, '02	L. & Glasgow	L. & Glasgow

Like the *King Edwards*, various boilers were given to them. All of them have one-fifth cylindrical boilers. The *Devonshire* and *Carnarvon* were otherwise given

Niclausse; *Antrim* and *Hampshire,* Yarrow; *Argyll,* Babcock; and *Roxburgh,* Dürr. The designed speed was exceeded by all on trials, but none have proved successful steamers ever since. They were completed between 1904 and 1905.

These were the last ships to be designed by Sir William White. He resigned his position from ill-health; but, like his predecessors, left under a cloud—at any rate, with his services not really appreciated. He had created a magnificent fleet; but its very magnificence made many of his designs look poor on paper against any foreign construction of less displacement, but—*on paper*—of equal or superior qualities. It is the fate of the naval architect in peace-time to be judged on paper with small regard to issues such as nautical qualities, constructional strength, and a score of other details which are not to be expressed by any statistical formulæ, but yet make all the difference between efficiency and the absence of it.

Sir William White's period of office was marked by an almost complete naval revolution. It began with the quick-firer and the disappearance of the low freeboard battleships. It ended with the coming of submarines, fire-control, and wireless. In between, it included the coming of the destroyer, the re-birth of the armoured cruiser; the arrival of the water-tube boiler, new forms of hull, unprecedented advances in both guns and armour—in fact, almost every conceivable change. Through these troubled waters with a steady hand and cool brain Sir William White guided the destiny of the Fleet and the millions of pounds expended in shipbuilding. Already his era is "the pre-*Dreadnought*" one, and to present-day ideas the term "pre-*Dreadnought*" is already

EARLY TYPE OF "27 KNOT" DESTROYERS.

very nearly akin to "pre-historic." His creations preserved the peace, for which very reason they failed to secure glory. Already some have gone to the scrap-heap, and others are well on their way thither to join the Reed and Barnaby ships in that oblivion to which modern *Dreadnoughts* will just as surely go in their season. More might be said: but *cui bono?* Such public epitaph as Sir William White received when he retired was of the "about time, too!" order. The creator of the finest fleet that the world has ever seen left office with less honour and no more public interest than did half-a-dozen mediocre admirals who had chanced to fly their flags in some of his creations. It is not given for the stage manager to stand in the lime-light reserved for the principal actors. But the historian of a hundred years hence, placing great Englishmen in perspective, will assuredly place Sir William White far ahead of many who loom greater in the public eye to-day.

GUNS IN THE ERA.

The guns which especially belong to the White era are as follows:—

Designation.	Weight. Tons.	Projectile. lbs.	Velocity. f.s.	Maximum Penetration with capped shot against K.C. at	
				5000 yds.	3000 yds.
13.5, 30 cal.	67	1250	2016	9	12
12in., 35 cal.	46	850	2367	11½	14½
12in., 40 cal.	50	850	2750	16	20
10in., 32 cal.	29	500	2040	5½	7½
9.2, 30 cal.	24	380	2065	4	6
9.2, 40 cal.	25	380	2347	6¾	9¼
9.2, 45 cal.	27	380	2640	8¾	11¼
7.5, 45 cal.	14	200	2600	5¾	7½
6in., 40 cal.	7½	100	2200	—	—
6in., 45 cal.	7	100	2535	—	4½

PURCHASED SHIPS.

In the year 1902 two ships, the *Constitucion* and *Libertad*, were laid down at Elswick and Vickers-Maxims' respectively for the Chilian Government. They were designed by Sir Edward Reed, and compare interestingly with the *King Edwards* in being much longer and narrower. It will be remembered that in the past Reed ideals had always centred round a "short handy ship." They had also always embodied the maximum of protection, while these ships carried medium armour only. His ships had, further, always been characterised by extremely strong construction, while these verged on the flimsy, the scantlings being far lighter than in British naval practice.

Out of all which it has been held that they represented the Reed ideal of armoured cruisers interlaced with whatever limitations the Chilian authorities may have specified.

Particulars of these ships, which in 1903 were purchased for the British Navy and renamed *Swiftsure* (ex *Constitucion*) and *Triumph* (ex *Libertad*) :—

Displacement—11,800. Complement, 700.

Length—(over all) 470ft.

Beam—71ft.

Draught—(Maximum) 24ft. 8in.

Armament—Four 10-inch, 45 cal. ; fourteen 7.5-inch, 50 cal. ; fourteen 14-pounders, four 6-pounders, four Maxims ; two 18-inch submerged tubes.

Armour—Practically complete belt 8ft. wide, 7-inch thick amidships, reduced to 3-inch at ends. 10-inch bulkheads at ends of thick portion of belt. Redoubt above (250ft. long), 7-inch on sides 6-inch bulkheads to it. Deck 1½-inch on slopes amidships, 3-inch on slopes at ends. Barbettes 10-inch, with 8 to 6-inch

turrets. Battery and upper deck casemates, 7-inch.
Horse-power—14,000=20 knots. Yarrow boilers.
Coal—(normal) 800 tons; (maximum) 2,000 tons.

These ships compare interestingly with the *King Edwards* and *Devonshires*, between which they struck a mean, as follows:—

	King Edward.	*Swiftsure.*	*Devonshire.*
Displacement	16,350	11,800	10,850
Principal Guns....	4—12in. 4—9.2 16—6in. 5—18in. tubes	4—10in. 14—7.5 2—18in. tubes.	4—7.5. 6—6in. 2—18in. tubes
Armour belt	9—2in.	7—3in.	6—2in.
Speed	18.9 knots	20 knots	22.25 knots
Coal (Normal)	950	800	800
Coal (Maximum) .	2,150—400 (oil)	2,000	1,800

Other items of interest are that the armament of the *Swiftsures* (10-inch and 7.5's) had somewhere about that time been laid down by Admiral Fisher as the ideal armament of the future, on the principle that the best possible was "the smallest effective big gun, and the largest possible secondary gun."

In service these ships never proved brilliantly successful. They rarely managed to make their speeds successfully, and there was a great deal of vibration with them. They were shored up internally in places with a view to strengthening them. On the other hand, it should be mentioned that some of these alleged defects have been put down to conservatism in nautical ideas, and that the shoring up was not really required. Their great drawback was that so far as the British Navy was concerned they were neither one thing nor the other, being too light in heavy guns to be satisfactory with the battleships, and too slow to act with the cruisers. Had

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there been six or so of them they would, possibly enough, have formed an ideal squadron. Being two ships only, they of necessity became round pegs in square holes.

NAVAL ESTIMATES IN THE ERA.

Financial Year.	Amount.	Personnel.	Ships.		
			Battleships.	Armoured Cruisers.	Protected Cruisers.
1887-88	12,476,800	62,500	—	—	3
1888-89*	13,082,800	62,500	—	—	2
1889-90	13,685,400	62,400	—	—	—
1890-91	13,786,600	65,400	8	—	42
1891-92	14,557,856	68,800	2	—	—
1892-93	14,240,200	67,700	1	—	—
1893-94	14,340,000	70,500	6	—	2
1894-95	17,365,900	83,000	3	—	9
1895-96	18,701,000	88,850	—	—	8
1896-97	21,823,000	93,750	6	—	3
1897-98	21,838,000	100,050	7	6	—
1898-99	23,780,000	106,390	3	4	—
1899-00	26,594,000	110,640	2	2	1
1900-01	28,791,900	114,880	2	6	1
1901-02	30,875,500	118,625	3	6	—
1902-03	31,255,500	122,500	2	2	—

In the following year 1903-04 three ships (the last of the *King Edwards*) were provided for. The total number of battleships designed for the British Navy by Sir William White was therefore 48. There were in addition 26 armoured cruisers—making a total of 74 armoured ships, and about as many protected cruisers, including some for Colonial service.

* Also under Naval Defence Act an additional sum of £10,000,000, spread over seven years.

III.

THE WATTS ERA.

SIR William White was succeeded by Mr., afterwards Sir Philip Watts, who came to the Admiralty from Elswick, where he had been Chief Constructor. He came with the reputation of "putting in plenty of guns," and his appointment was favourably received, both inside the Navy and outside.

The armoured cruisers *Duke of Edinburgh* and *Black Prince* were the first ships for which he was personally responsible.

Details of these :—

Displacement—13,550 tons.

Length (between perpendiculars)—480ft.

Beam—73½ft.

Draught—(maximum) 27½ft.

Armament—Six 9.2, 45 cal., ten 6-inch, 50 cal.; twenty-two 3-pounders. Torpedo tubes :—Three submerged (18in.).

Horse-power—23,500=22.3 knots.

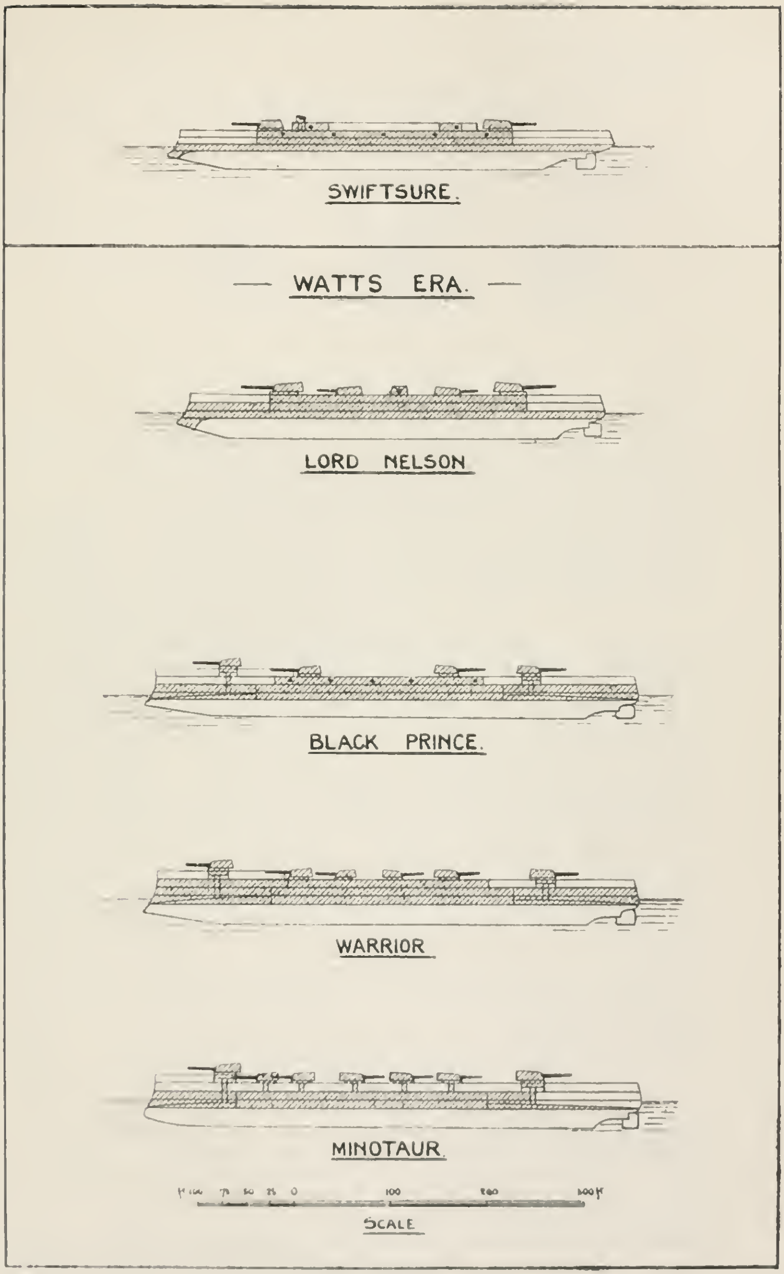
Coal—(normal) 1,000 tons ; (maximum) 2,000 ; also 400 tons of oil.

The former ship was laid down at Pembroke and engined by Hawthorn ; the latter was built and engined by the Thames Iron Works. In the matter of armament and its arrangement the ships were to some extent cruiser versions of the *King Edward ;* but equally, in the adoption of a number of single gun-houses for big guns, and the jump from two to a larger number of big guns, the influence of the Chilian *O'Higgins,* built at Elswick, may be noticed. The big guns were placed one forward and one aft, two on either beam and two on either quarter. The 6-inch were placed in an armoured battery below. As originally designed, right ahead fire was given to the forward battery guns, but this was dispensed with at a latter date. The ships were never good sea boats, and the 6-inch guns were soon found to be well-nigh useless in any sea.

The armour was disposed in generous fashion—a complete belt reaching up to the main deck, 4in. forward, 6in. for some 260ft. amidships, and 3in. aft of that. A 6in. battery (K.N.C.) with bulkheads surmounts the belt. 7in. barbettes with 6in. K.C. flat-sided gunhouses.

Both were given a mixed installation of Babcock and cylindrical boilers. A novelty was the standardisation of all their machinery, a very valuable innovation, which has been followed ever since. Parts of any one ship's machinery can be used for any other of her class, thus facilitating rapid repairs and requiring a considerably reduced stock of spares.

On trials the *Duke of Edinburgh* did on her eight hours' full power trial I.H.P. 23,685=22.84 knots, the *Black Prince* 23,939=23.6 knots. In service, however, the former has generally proved the better steamer. Another innovation in these ships was the re-appearance of the stern torpedo tube, first introduced in the *Centurions.* As re-introduced it was built submerged, a feature long desired, but which had previously presented innumerable difficulties in design.



PRE-DREADNOUGHTS OF THE WATTS ERA.

For the Estimates of the following year (1903-04) four more ships of the same type were provided—

Name.	Laid down.	Builders.	Engines by.
Achilles	Feb. '04	Elswick	Hawthorn
Cochrane	Mar. '04	Fairfield	Fairfield
Warrior	Jan. '04	Vickers	Vickers
Natal	Nov. '03	Pembroke	Wallsend Co.

In these the defect of the low 6-in. battery of the *Black Princes* was anticipated, and instead of ten 6-inch guns, four 7.5 were mounted in gun-houses on the upper deck amidships. Yarrow and cylindrical boilers mixed were installed. Otherwise no change was made. On trial the *Achilles* reached a maximum of 23.27, the other three ships all made their contracts or over.

These four, generally known as the *Warriors*, proved to be the finest cruisers as sea-boats ever built for the British Navy. They have always proved most remarkably steady gun platforms. Shooting from them is invariably good—they have always been near the top of the list in gunnery returns. For a single ship in a single commission good shooting is attributable to causes other than the ship; but with four ships and different crews at different times the effect of the design is obvious. Apparently the extra weight on their upper decks is responsible; for their dimensions are identical with those of the unsatisfactory *Black Princes*.

In all these ships, as in the *Devonshires* which preceded them, raking masts and stumpy funnels were introduced. The latter proved most inconvenient for navigating purposes, and in 1911 all the *Warriors* had their funnels considerably heightened.

In these four latter the "dove-cot" platform fire-controls first appeared; they were fitted also to the three latest ships of the *King Edward* class.

The main defect of all six is the trivial anti-torpedo armament. The 3-pounders are perfectly useless against destroyers. Incidentally it may be noticed that the class signalled the scientific placing of such guns for control purposes. In the *Warriors* some guns were mounted on turret tops also, this being with a view to their survival after an action. It was contended that an actual hit was extremely improbable on any anti-t.b. guns, but that shells bursting underneath might easily disable them. Hence the search for an armoured base. This idea seems to have originated in the German Navy, though the Germans never adopted the turret-top position.

The Estimates (1904-05) provided for two battleships and three armoured cruisers. The latter of these, the *Minotaur* class, were "improved *Warriors*"; but, as a matter of fact, except for a larger armament, they proved somewhat inferior to their immediate predecessors:—

Details are:

Displacement—14,600 tons (as against 13,550).

Length (between perpendiculars)—490ft., (over all) 525ft.

Beam—74½ft. (but a foot more in *Shannon*).

Draught—(maximum) 28ft. (but a foot less in *Shannon*).

Armament—Four 9.2, 50 cal., ten 7.5, fourteen 12-pounders, five 18in. tubes (submerged).

Horse-power—27,000=23 knots.

Coal—(normal) 1,000 tons (950 only in *Shannon*); (maximum) 2,000, also 400 tons oil.

SIR PHILIP WATTS.

The 9.2 were placed in double turrets fore and aft. For those of the *Minotaur* electric manœuvring was substituted for the usual hydraulic. The 7.5's are disposed in ten single gun houses on the upper deck, *Warrior* fashion. The armour belt is of the same maximum thickness, but only 3in. for 50ft. from the bow. Thereafter it thickens gradually for the next 75ft. then reaches its maximum. Vertical armour above the main deck was given up in order to allow for the increased weight of armament and its protection—a total of 2,073 tons. The *Minotaur* has Babcock, the other two Yarrow large-tube boilers. No cylindricals were fitted; the opponents of the water-tube system having lost their influence by 1905, when the ships were laid down.

None of these ships came up to expectations on trial, though they developed considerably more than the contract horse-power. The *Minotaur* just made her speed, the *Defence* just failed to reach it, the *Shannon* failed by half-a-knot. This last ship had been varied from the others with an idea that a new form of hull, would produce better speed—an unfortunate surmise. shortly after completion all had 15ft. added to their funnels. The increased draught added to their power somewhat, but did not materially better their speeds.

Further details of these three ships are :—

Name.	Laid down.	Built at.	Engined by.
Minotaur..............	Jan. '05	Devonport	Harland & Wolff
Defence...............	Feb. '05	Pembroke	Scott S. & E. Co.
Shannon..............	Jan. '05	Chatham	Humphrys

All were completed in 1908. Average cost, £1,400,000 per ship. In them solid bulkheads first appear, their engine-rooms having no water-tight doors.

The battleships of the same programme (1904-05) were the *Lord Nelson* and *Agamemnon*.

Details are :—

Displacement—16,500 tons.

Length (between perpendiculars)—410 ft., (over all) 445ft.

Beam—79½ft.

Draught—(mean) 27ft.

Armament—Four 12-inch, 45 cal., ten 9.2, 50 cal. fifteen 12-pounders, sixteen 3-pounders, five submerged tubes (18in.).

Horse-power—16,750=18.5 knots.

Coal—(normal) 900 tons ; (maximum) 2,000 tons ; also 400 tons oil.

The *Lord Nelson* was built and engined by Palmer, the *Agamemnon* by Beardmore and engined by Hawthorn, The former was given Babcock, the latter Yarrow boilers. Both on trial easily exceeded the contract speed, and proved abnormally handy ships. They cost £1,500,000 or only a little more than the *Minotaurs*.

The *Nelsons* are often counted as " Dreadnoughts " ; but their only claim to the position is they do not happen to carry any 6-inch guns. Actually they are nothing but improved *King Edwards*, bearing to those ships very much the same relation as the *Warriors* to the *Black Princes*. Their comparatively slow speeds and their mixed armaments entirely differentiate them from the swifter " all-big-gun " ship which followed, and, for that matter, caught them up.*

The *Nelsons* were never really successful ships outside the points alluded to above. Eight of their ten 9.2's

* The *Nelsons* were delayed in completion, as the 12-inch guns made for them were appropriated for the *Dreadnought*, in order to ensure rapid completion of that ship.

were placed in twin turrets, and in many circumstances two 9.2 so mounted proved very little superior in efficiency to a similar single gun in an isolated gun-house.*

In the matter of protection the *Nelsons* far exceeded the *King Edwards.* In place of a 9in. belt amidships they were given a 12in. one, while the 8in. and 6in. strakes above of the earlier ships became a uniform 8in. The bow belt forward was also augmented to 6in. on the water-line, surmounted by 4in., instead of a belt uniformly increasing from 2in. to 6in. further aft. But none of this made them "Dreadnoughts," and the absence of "Dreadnought" features relegated them to the second line very soon after they were completed.

In these ships the tripod mast, the idea of which dates back to the *Captain* era, re-appeared. The *Nelsons* were given as mainmasts the first of those modern tripods which have characterised nearly every British capital ship since built till the *Lion* was altered.

The idea of the tripod mast is to avoid the many shrouds of an ordinary mast; and so give greater training to the guns. Whether the idea be of use is another matter. Generally speaking ideas abandoned by our forefathers have failed to live long if resuscitated.

In the 1902-03 and 1903-04 Estimates provision was made for four vessels each year of a new type, known as "Scouts." These were the *Adventure* and *Attentive* (Elswick), *Forward* and *Foresight* (Fairfield), *Pathfinder* and *Patrol* (Laird), *Sentinel* and *Skirmisher* (Vickers-

* To some extent this is probably true of slower firing of larger guns. The only warships with single 12-inch—the Italian *Victor Emanuele* class—have generally achieved almost as many hits at target practice as the *Brine*, with two pairs of 12-inch. Improved mountings have since appeared, but certain advantages still seem inevitable to the single gun. Its disadvantage lies, of course, in much extra weight, and to-day in the space question also.

Maxim). One was awarded each year to each of the firms mentioned, but all were actually laid down between June, 1903, and January, 1904. The first four to be given out to contract were originally named *Eddystone*, *Nore*, *Fastnet*, and *Inchkeith*.

These vessels came to be built owing to an appreciation of the fact that destroyers had altogether lost their original rôle and had become torpedo-boats, pure and simple. The "Scouts," though from three to four times the size, were the old "catchers" re-introduced. They compared with these as follows :—

	Average Displacement.	Average Designed Speed.	Armament.
"Scouts".	2850	25	12 to 14—12 pdr., 2—14in. tubes*
Halcyons .	1070	18.5	2—4.7, 4—6pdr., 5—18in. tubes

A $1\frac{1}{2}$ deck on slopes amidships was provided for the "Scouts," which incidentally were designed for ten 12-pounders only. By the year 1912 it became abundantly clear that, like their predecessors the "catchers," they were doomed to pass quickly into the "little use" category on account of their weak armaments and small sea-keeping capacity.

TORPEDO CRAFT.

It has already been mentioned that Sir William White's period of office saw the coming of the destroyer. The origin of this craft is to be found in a public agitation, which arose out of the tremendous attention paid to torpedo boats by the French, who were then our most likely enemy, and who had an overwhelming superiority in torpedo craft.

Some years before a type of craft, the torpedo gunboats already referred to, which were first known

* Armament recently altered to 9—4 inch.

as "torpedo boat catchers" and subsequently as "catchers" had been introduced. It soon, however, became very clear that they were little likely to achieve this end, and the doctrine that "the torpedo boat is the answer to the torpedo boat" was being steadily preached. At that time (1892) the then insignificant navy of Germany was in possession of eight very large torpedo boats, which were known as "division boats." Austria also had one or two fast craft, capable of dealing with torpedo boats. Upon these existing lines a new type of craft was developed for the British Navy. The first two to be built were the *Havock* and *Hornet*, which were launched in 1893. In substance they were very large torpedo boats of about 250 tons displacement, designed by Messrs. Yarrow. Their speed of 27 knots was well in excess of that of any existing torpedo boat, and it was confidently expected that they would easily run down and destroy any such. In addition to what was then the very considerable armament of one 12-pounder and three 6-pounders, they were also fitted with torpedo tubes.* The original idea of this was that when hostile torpedo boats had been annihilated by them, the destroyers could be used as torpedo boats in case of need.

In 1894 the *Havock* and *Hornet* were used in manœuvres and tested by being made to lie by for twenty-four hours in the Bay of Biscay. They underwent the test very well, and to this is probably attributed the realisation of the fact that in them a more or less really effective sea-going torpedo boat had been evolved. A large number of duplicates were ordered; at first of 27 knots. Later this was increased to 30, and in a few boats to a little more.

* They had a bow tube besides broadside tubes. This bow tube was soon done away with and a couple of 6-pounders substituted.

The whole of these boats were nothing but enlarged editions of existing torpedo boats, and some of them proved rather weak for the service demanded of them. In the year 1902 and onwards, therefore, a type of better sea-going qualities was demanded, and the River class, which totalled about 35 boats, began to be built. A feature of the River class was that they were a blend of the early torpedo gunboats of the Rattlesnake type, with the later and heavier torpedo gunboats. There was a reduction of speed to 25½ knots, with a view to securing better sea-going qualities. On account of their slow speed the River class are verging on the obsolete to-day, but the high forecastle first embodied in them has never been departed from, and the very latest types of destroyers are nothing but swifter and larger editions of them.

It is interesting to note that here again to some extent the Germans led the way. German destroyers had the North Sea to consider, whereas all early British destroyers were built with a view to being used only in the Channel. Consequently and naturally enough the Germans were the first to perceive the necessity for a high forecastle.

The submarine also appeared in the pre-Dreadnought era, but the boats of that time were of such a primitive type that they need hardly be specially mentioned. They will be found alluded to in a later chapter.

END OF THE PRE-DREADNOUGHT ERA.

So ended the pre-Dreadnought era. It was characterised by a multiplicity of types which had included :—

First class battleships.
Second class ,,
Fast intermediate ,,

First rate armoured cruisers.
Second rate ,, ,,
First class protected cruisers.
Second class ,, ,,
Third class ,, ,,
Scouts.
Torpedo gunboats.
Sloops.
Gunboats.
Destroyers.
Torpedo boats.
Submarines.

Although the whole of these types were not all building or provided for at any one and the same time, yet towards the end of the period there was a general feeling that too many types of ships were in use. Reductions in this direction were announced, at first indicating that in future programmes provision would be made only for :—

"Armoured ships."
Destroyers.
Submarines.

Contemporaneously with this came Admiral Fisher's famous "scrap-heap policy," whereby some eighty vessels of one kind and another were struck off the effective list, and either sold or relegated to subsidiary service.

The ships removed included all battleships and armoured cruisers of earlier date than the *Trafalgar*, several ships of the *Apollo* class, all earlier protected cruisers, some of the "P" class, and the bulk of the small fry in the way of sloops and gunboats.

This action aroused a certain amount of criticism on the grounds that the clearance was excessive. As some of the ships were subsequently restored to the active list, something is undoubtedly to be said for that point of view; especially as no steps were taken to replace the scrapped cruisers. On the other hand, most of the ships removed were of trivial fighting value; though here again the zeal of the reformer somewhat overlooked the fact that the police duties rendered by the small fry had been valuable.

In connection with this policy some of the outlying naval bases were done away with, and there commenced a "reorganisation" of the Fleet which has continued intermittently from that day to this! Certain other considerable changes affecting the *personnel* will be found dealt with in a later chapter.

IV.

THE DREADNOUGHT ERA—(WATTS).

A NEW era in battleship design, not only for the British Navy, but for the navies of the entire world, was opened with the advent of the *Dreadnought*. As has been seen, it was in a way led up to by previous designs, notably the *Lord Nelson* class. The essential point of difference, however, lies in the fact that whereas the *Lord Nelson* carries heavy guns of two calibres, in the *Dreadnought* the main armament is confined to one calibre only. The advantages of this on paper are not particularly great, but for practical purposes, such as fire control and so forth, the superiority to be obtained by a uniformity of big gun armament is tremendous.

As the historical portion of this book indicates, the "Dreadnought idea" has been a fairly regular feature of British Naval Policy, but in this particular case the inception would seem to have been due to accident and circumstance rather than to any settled policy.

Immature and abortive attempts to realise something of the "Dreadnought ideal" had taken place in the past. The earliest ship claimed to represent the Dreadnought ideal was the U.S. *Roanoake*, built at the time of the Civil War. This was a high freeboard ship, fitted with three turrets in the centre line. A few years later something of the same sort found expression in the four-turreted British *Royal Sovereign* and *Prince Albert*, though these were merely coast defence ships. Still later in the *Tchesma* class, Russian, and in the *Brandenburg* class of the German Navy, six big guns were installed as the primary armament. Both these two ideas were laughed out of existence; and it became a settled fashion to carry four big guns, two forward and two aft.

Matters were at this stage when the late "Colonel" Cuniberti, Constructor to the Italian Navy, conceived the idea of a ship carrying a considerable number of big guns, and embodying in herself the power of two or three normal battleships. This design was considered altogether too ambitious for the Italian Navy; but permission was given him to publish the general idea, subject to official revision. It first saw the light in "*Fighting Ships*," in 1903, and is now so historically interesting that I here reproduce the article in full, the original being long since out of print:—

"Admiral Sir John Hopkins, late Controller of the British Navy, in his admirable article, 'Intermediates for the British Fleet,' published in the last edition (1902) of this Annual, asks what results it would be possible to obtain in the British Navy by extending the ideas of the two Italian Ministers of Marine, Admiral Morin and Admiral Bettolo, which were translated into fact in the *Vittorio Emanuele III* (12,625 tons), so as to arrive at the much greater tonnage of recent British battleships, in the same manner as the ideas that found concrete form in the projected vessels of the *Amalfi* class were amplified and realised in the Italian battleships alluded to and regarding which, even now, so many doubts are expressed as to such realisation being practicable.

V. L. Cuniberti

GENERAL CUNIBERTI.

"To proceed from 8,000 to 12,000, and from 12,000 to 17,000 tons of displacement, constitutes not only a problem of naval architecture, but also involves high considerations of quite another nature, such as the special functions of the Fleet, so as to harmonise with the political objects of any given maritime Power, the geographical position of that Power, the state of its finances, etc., etc. So that not only does the answer to such a question entail a certain amount of difficulty from the constructive point of view, but before the answer can be seriously considered it is absolutely necessary to determine exactly what end this ideal British battleship is to serve; for it is not to be imagined that we are going merely to enlarge the *Vittorio Emanuele* until we arrive at a displacement equal to that of the *King Edward VII.* For example, putting an extra 4,000 tons on board will produce a vessel that will perhaps be a little steadier in heavy weather than the original ship.

* * * * *

"In Britain are to be found naval experts of the highest possible order, and they will have their own ideas as to what type of vessels best fulfil the needs and ideals of the British Fleet, so that it would almost appear a presumption on my part to offer suggestions for any Navy other than the Italian. But in deference to the courteous interrogation of Admiral Hopkins I may be permitted to point out that from the purely human point of view there are two leading methods by which one can strike to the ground one's opponent, either by gradually developing the attack and disposing of him little by little, or, on the other hand, killing him at one blow without causing him prolonged suffering. In like manner there are two distinct modes of sending an enemy's ship to the bottom.

"Let us take, for example, a human combat. The first—the most commonly used, and the most practical in the majority of cases—has as its basis the progressive dismemberment of the enemy.

"Two mortal foes place themselves on guard at a distance; they begin with exceptional strokes, with feints, with opportune advances and retreats, never coming to close quarters for a deadly blow until the capabilities of the enemy, both offensive and defensive, are well tested, and until some fortunate stroke, even although not actually deadly, has considerably weakened the foe, has rendered his defence less able, and has somewhat demoralised him. Covered with blood, stunned, mutilated, and hardly capable of remaining on his feet, then comes the moment when his adversary closes in upon him and delivers the final and mortal blow. And we may almost imagine we hear the beaten one, with thick and choking voice, repeat the terrible words of Francesco Ferruccio at the battle of Gavinana: 'Maramaldo, thou but killest a man already dead!'

"Similarly, two opposing ships, with but slight differences in their powers, will commence their combat at a great distance, utilising their evolutionary abilities and their speed in prudent manœuvres, seeking to gain as much advantage as possible from their offensive powers, and attempting to place every obstacle in the way of the antagonist utilising powers in either direction. The discharge of projectiles will commence in earnest, greatly assisted by the rapid loading of which the guns of medium and small calibre are now capable. What results can reasonably be expected from the discharge of the smaller guns at such great distances is hard to say; nor can the slender expectation of, let us say, chancing to hit the captain of the opposing ship in the eye with a lucky shot, at all justify such a waste of ammunition. Gradually nearing one another, the ships manœuvring less freely, hits will become more dangerous; the boats that were not set adrift before the action began will be alight and burning fiercely; the cowls of the wind trunks, the funnels, and the masts will be in fragments.

"The crew, wounded and reduced in numbers, will have lost their calm, and consequently the firing will have become wilder; finally, one of the two antagonists will get in a lucky shot that will disable the other. She will speedily become unmanageable, and her enemy will as speedily close into within the thousand metres which will permit of a torpedo being launched with every chance of success, or the battle may be concluded by a final rush and the point of the ram.

"As the wounded hull sinks slowly beneath the waves, the flag which had put such heart into the crew, and the sight of which had spurred them to fight to the last, may well seem as it disappears to repeat to the enemy these sad words, 'Thou but slayest one already dead.'

"Four ships in place of two, eight in place of four, will repeat in a perhaps more complex action the same phases of attack, and the same foolish waste of ammunition, which in these days causes the greatest preoccupation of those who, having to design warships, must decide on the quantity of ammunition and projectiles provided for each different calibre of the armament.

* * * * *

"There is, however, another method of fighting and sending your enemy to the bottom; but it is one that is capable of adoption only by a Navy at the same time most potent and very rich.

"Let us imagine a vessel whose armour is so well distributed and so impervious as to be able to resist all the attacks of an enemy's artillery with the exception of the projectiles of the 12-inch guns. Such a ship could approach her enemy without firing a shot, without wasting a single round of ammunition, absolutely regardless of all the scratchings that her antagonist might inflict on the exterior of her armour plates.

"And as to-day the belts of fighting ships are generally of such thickness that, when we leave the results of the proving ground and come to the conditions of actual combat, we find that it would be more than difficult to penetrate them with 6-inch guns, we see at once that it would be useless to equip our contemplated ship with such artillery.

"Further, if this ideal vessel which we have imagined to be so potently armoured is also very swift, and of a speed greater than that of a possible antagonist, she could not only prevent this latter from getting away, but also avail herself of her superiority in this respect for choosing the most convenient position for striking the belt of the enemy in the most advantageous manner.

"For this swift vessel a numerous and uniform armament of 8-inch guns, such as was contemplated for the *Amalfi* class,* would appear to be sufficient, if we had only to consider the penetration at right angles of modern belts, especially if capped projectiles are adopted.

* The vessels of the *Amalfi* class designed by Col. Cuniberti in 1899 were of 8,000 tons displacement; they were to have been armed with twelve 203-m/m (8-inch), twelve 76-m/m (12-pounders), and twelve 47-m/m (3-pounders). The armour belt was 152-m/m (6-inches) thick, as also was the armour of the battery and of the turrets. The engines were to be 19,000 H.P., and the speed with 15,000 H.P. was to be 22 knots.

"If, however, the hit is an oblique one, and the distance is considerable, it appears necessary that we should adopt the calibre of 12-inch if we want to be absolutely certain of sinking the adversary, striking him *only* on the belt. But the loading of such guns is as yet very slow, although it has been greatly improved of late. Besides, the number of hits that one can get in on to the belt itself is small. From this it appears that in our ideal and intensely powerful ship we must increase the number of pieces of 12-inch so as to be able to get in at least one fatal shot on the enemy's belt at the water-line before she has a chance of getting a similar fortunate stroke at us from one of the four large pieces now usually carried as the main armament.

"We thus have outlined for us the main features of our absolutely supreme vessel—with medium calibres abolished—so effectually protected as to be able to disregard entirely all the subsidiary armament of an enemy, and armed only with twelve pieces of 12-inch. Such a ship could fight in the second method we have delineated, without throwing away a single shot, without wasting ammunition. Secure in her exuberant protection with her twelve guns ready, she would swiftly descend on her adversary and pour in a terrible converging fire at the belt.

"Having disposed of her first antagonist, she would at once proceed to attack another, and almost untouched, to despatch yet another, not throwing away a single round of her ammunition, but utilising all for sure and deadly shots. A large and abundant supply of 12-inch projectiles and ammunition can be provided, in addition to the belt and guns contemplated, out of the 4,500 tons of increase of displacement that will be disposable in the enlargement of the *Vittorio Emanuele III* to become the national British type of vessel in place of the *King Edward VII.*

"It will be necessary to defend our '*Invincible*' with a thick complete belt of twelve inches, and a battery also protected with the 12-inch armour (for the redoubt must be thus defended as well as the water-line, so as to eliminate the perils of the first system of attack sketched out, of progressive damages being adopted against her); and at the same time she must be armed with twelve pieces of 12-inch, arranged as in the *Amalfi* class or in the *Vittorio Emanuele III*, so as to be able herself to attack in the second method that has been outlined, that is to say, the system of the stronger, of the better defended, and most certainly that of the richer. But when a certain number of such colossi of 17,000 tons—six, for example—had been constructed, it is more than probable that the adversary would do his utmost to prevent their getting near him, and, fearful of the fatal result of so unequal a combat, would seek to betake himself elsewhere immediately on the appearance of the famous *Invincible* division.

"In that case the command of the seas, or a deluded belief that they have such command, will remain with these *Invincible* ships, even although they may be of slow speed; but to stop at this point would be too little and unworthy of the Navy of the richest and most potent Power in the world.

"For this squadron or division, however 'invincible,' will not be really and truly *supreme* if it cannot also catch hold of the enemy's tail. The bull in the vast ring of the amphitheatre deludes himself with the idea that because he is more powerful than the agile toreador he therefore has absolute command of the scene of the combat; but he is too slow in following up his adversaries and these almost always succeed in eluding his terrible horns.

"We must, therefore, come to the conclusion that the type of vessel will not be absolutely *supreme* and worthy of such a nation unless we furnish it with such speed that it can overtake any of the enemy's battleships and oblige them to fight. It is, then, possible to give to a vessel of 17,000 tons displacement—

Protective armour of 12ins.

Twelve guns of 12-inch calibre.

An abundant supply of ammunition, and

A very high speed, superior to that of all and existing battleships afloat.

"It has been said and written—indeed, repeatedly written—that the *Vittorio Emanuele III* was a practical impossibility. But before long she will be actually in the water, and facts already show how vain were the suppositions and criticisms of such croakers.*

"But it has also been asserted that in the case of this vessel surpassing the contemplated speed of 21½ knots on trial and attaining that hoped for of 22 knots, such would only prove that that particular tonnage of displacement especially lends itself to obtaining a form of hull with which we can realise a very high speed, and more so than with larger ships. This, however, is not quite exact. The law which governs the speed and displacement, other things being equal, is well known to all naval constructors, who have by heart the rule that whilst the

* The *Vittorio Emanuele* proved a most successful ship, answering all expectations of her. One of her chief novelties was the employment of a special girder construction, and the scientific reduction of all superfluous weights upon a scale never before attempted. Though apparently lightly built the ship was found to be abnormally strong.

displacement increases as the cube of the dimensions, the resistance, on the other hand, at a given speed does not increase in the same proportion as the displacement. The pith of the kernel lies in utilising the most opportune dimensions, or, rather, let us say, in adopting the special form of hull most adapted to those dimensions, more than in the actual amount of the displacement itself.

"The amount of the displacement, however, is intimately bound up with the question of the defensive and offensive powers that it is wished to give to a ship; so that once the particular objectives of the Italian Navy had been laid down, and thereby the defensive and offensive power sought for decided on, the question resolved itself into harmonising them with a form of hull of the greatest possible efficiency, and this worked out at 12,600 tons. Nor does it appear that the problem could have been satisfactorily solved with a vessel of less displacement, as in that case it would have been impossible to realise the required power, while with a greater displacement the ship would have been incapable of obtaining the desired speed.

"In the same manner the defensive and offensive power of the projected ships of the *Amalfi* class was harmonised with a form of hull of such high efficiency that it would have been possible to obtain a speed of 23 knots and probably more; but the statement that the problem could not have been solved with a displacement of much less or much greater tonnage than that projected, is not to be taken as insisting that the solution must be interpreted in a too absolute manner, asserting that the speed of 23 knots could not be efficiently obtained save with a displacement of from 8,000 to 9,000 tons, for this would be inexact.

"If now the question be put—Is it possible for some naval architect to design a special form of hull having a displacement of 17,000 tons, and with which we can realise a very high speed—twenty-four knots, for example?

"'Without doubt,' will answer all practical naval constructors.

"If we go further, and ask—Is it possible for him at the same time to arm such a vessel with twelve pieces of 12-inch?

"'Without doubt,' will answer but a certain number of such experienced men.

"But if we go still further, and demand, finally—Is it also possible for him to protect such a ship with 12-inch armour?

"'Without doubt,' will answer only one here and there who may have already made researches in that direction.

"And as the solving of such a problem necessitates many and many a calculation, and no amount of discussion or argument on the matter could in any way be conclusive unless based on definite plans and figures, these lines might well conclude here.

"But, in deference to the courteous inquiry of Admiral Hopkins, this brief article must not be allowed to close in a manner so indefinite.

"I would, therefore, say frankly at once that the designs for such a vessel have already been worked out, and that its construction seems quite feasible and attainable. Following up the progressive scale of displacement from 8,000 to 12,000 tons, and then on to 17,000 tons, a new *King Edward VII* has been designed, 521½ft. (159 metres) in length, with a beam of eighty-two feet) twenty-five metres), and mean draught of 27ft. (8.5 metres); with the water-line protected with 12-inch plates, and the battery similarly armoured; having two turrets at the ends, each armed with a pair of 12-inch guns, and two central side turrets high up (similar to the two with 8-inch guns in the *Vittorio Emanuele III*), also each armed with two pieces of 12-inch, and four turrets at the four angles of the upper part of the battery, having each one 12-inch gun.

"This vessel has no ports whatever in her armour; she carries no secondary armament at all, but only the usual pieces of small calibre for defence against torpedo attack.

"The speed to be realised, as proved by the tank trials, is twenty-four knots."

The idea was at first received with derision and scepticism, which lasted until, in the Russian-Japanese War, it was announced that the Japanese had laid down two battleships, the *Aki* and *Satsuma*, which "were to be more or less on the lines of the ship projected by Colonel Cuniberti." Contemporaneous with this the United States authorised the building of the *South Carolina* and *Michigan*, which carry eight 12-inch guns, so disposed as to be available on either broadside.

Both these ideas were public property before the British *Dreadnought* was laid down. She was, however, built with such rapidity that she was completed long before any other vessel of the type.

In the design for a new type of British capital ship, a great many ideas were considered and rejected. Eventually, however, it was decided to equip the *Dreadnought* with five turrets so disposed that eight guns were available on either broadside and six guns available

THE "DREADNOUGHT" 1906

ahead or astern. The designed speed of the ship was twenty-one knots.

Together with this type of ship, another type, somewhat more resembling the Cuniberti ideal, was laid down. Three ships of this class, the *Invincible* class, were designed for a speed of twenty-five knots, and given big guns so disposed that eight guns were available on either broadside and six big guns ahead or astern.

The *Dreadnought* was officially laid down in December, 1905, and completed ten months later. Actually, however, materials for her were collected months beforehand, and the rate at which she was built,* like the secrecy with which her building was surrounded, consisted in great measure of a theatrical display, very impressive to the general public at the time, but to-day generally regarded as "unfortunate" on account of the foreign attention thus attracted. But, while the previous chapter is clear proof of the futility of any real secrecy about the "Dreadnought idea," so far as the British Navy was concerned, it likewise serves to refute a charge which has been made to the effect that the "secrecy policy" induced foreign nations to build Dreadnoughts also. The most that can be said is that had the *Dreadnought* been built without so much attention being attracted to her, foreign nations might have been less in a hurry to copy her. But it is absolutely clear that the all-big-gun ship era had arrived, just as in the past the ironclad era came, or, in earlier days still, the gun and steam eras did. The actual place of the *Dreadnought* in history is that she marks a wise and rapid recognition of new conditions.

* The false impression that a British battleship could be built in about a third of the time that German ships take to construct had far more to do with subsequent shipbuilding reductions than any deliberate ignoring of naval needs, such as those responsible were accused of.

Details of the *Dreadnought* are as follows :—

Displacement—17,900 tons.

Length—526ft. (over all).

Beam—82ft.

Draught—Maximum, 29ft. (normal).

Armament—Ten 12-inch, 45 cal. ; twenty-seven 12 pounders ; five submerged tubes (18 inch).

Armour Belt—11-in. to 6-in. forward ; and 4-in. aft. On turrets 11-inch (K.C.)

Machinery—Parsons Turbine ; four screws.

Horse-power—23,000=21 knots.

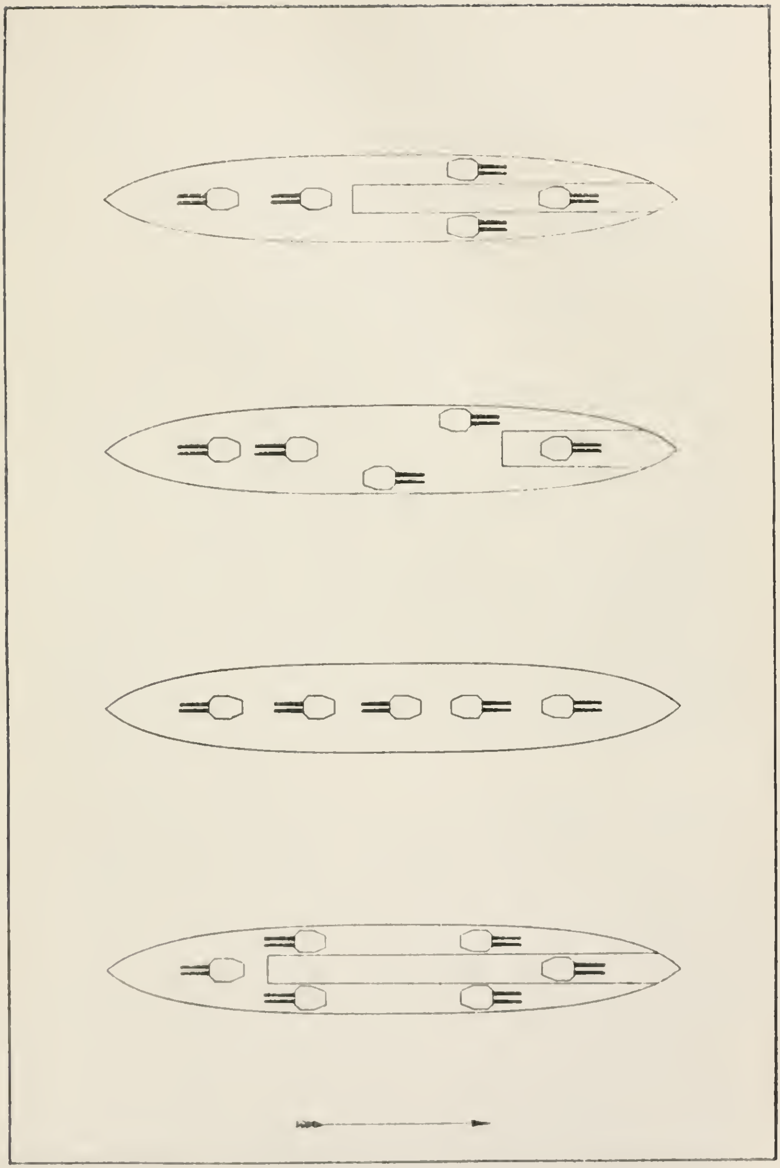
Boilers—Babcock.

Coal—(normal) 900 tons ; (maximum) 2,000 tons ; oil fuel also.

Built at Portsmouth ; Engined by Vickers.

The *Dreadnought* was unique in every particular. The exact disposition of her big gun armament was only arrived at after a long and careful consultation, and the consideration of a number of alternatives. It admits of eight big guns bearing in nearly every position, and allows a minimum fire of six in any case. It is understood that, in addition to the plan actually adopted, in the earliest plan of all (which was merely an adaption of the *Lord Nelson* class), consideration was given to a scheme of five turrets, all in the centre line, and also to an arrangement whereby the two amidship turrets would be placed *en échelon.*

One of the particular arguments in favour of the plan ultimately adopted was that next to four, eight big guns form the best workable unit for fire control purposes. It was also considered that eight guns would probably be the maximum that could safely be fired together continuously, with full charges in battle conditions.



ALTERNATIVE DESIGNS FOR THE DREADNOUGHT.

In these days when all big gun armaments are the rule, there is a tendency to overlook the fact that the *Dreadnought's* main armament was double that of previous ships, with only a comparatively small increase of displacement, and that no intermediate experience existed as to what might be expected.

With a view to standing the shock of discharge, the *Dreadnought* was built with very heavy scantlings and generally given an immensely strong hull. The armouring followed orthodox lines, except that a certain amount was applied internally under-water as a protection against torpedoes. In addition she was given solid bulkheads,* though this was no novelty except with the British Navy, as they had been introduced some years before in the battleship *Tsarevitch* and the armoured cruiser *Bayan*, built for the Russians at La Seyne. Another novelty in the *Dreadnought* was the adoption of a high forecastle, she being the first British battleship in which this appears. Another innovation was the placing of the officers' quarters forward and putting the men aft, a system which, however, has since been abandoned in the most recent vessels.

The greatest novelty of the *Dreadnought*, however, was the adoption of turbine machinery, and the form of her hull, with a 30ft. overhang aft, in order to adapt the ship to the new means of propulsion. The fitting of turbines to the new *Dreadnought* was perhaps an even greater novelty than her armament, she being the first warship, other than small cruisers, to be so equipped.

The introduction of turbines was regarded with a

* They first appeared, as already recorded, in British cruisers of the *Minotaur* class. Their safety record is to be found in the survival of the *Pallada* at Port Arthur; their inconvenience in the fact that in the *Neptune* they were abandoned.

good deal of apprehension in certain quarters, especially when it became known that the three other big ships belonging to the same programme were also to be turbine propelled. The type selected for all was the Parsons with four shafts. The wing shafts of the *Dreadnought* have each one high pressure ahead and one high-pressure astern turbine. The amidship ones are fitted with three turbines each—one low pressure one ahead, and one low pressure astern, and one turbine for going astern. Each turbine has 39,600 blades.

On her first trials the *Dreadnought* exceeded her designed speed for short spurts by three-quarters of a knot, but on the eight hours' run barely succeeded in making a mean of twenty-one knots. Shortly afterwards she fell a little below this, but at a later date picked up again, and on more than one occasion since she has easily made twenty-two knots or over. Such early difficulties as occurred were due to the fact that her engine-room complement were at first necessarily unfamiliar with working so large an installation. The total cost of the *Dreadnought*, which belongs to the 1905-06 programme, was £1,797,497, and save that her draught somewhat exceeded anticipations, the ship was a success in every way, proving a remarkably steady gun-platform.

The Committee which sat on the *Dreadnought* design was by no means entirely unanimous as to what sacrifice should be made for speed. The *Dreadnought* herself, despite a considerable increase of speed as compared with the battleships that preceded her, did not obtain that speed by the sacrifice of any battleship qualities, but almost entirely on account of the substitution of turbines for reciprocating engines. To that extent, therefore, though nearly as fast as the armoured cruisers of a few years before, she may be said to have developed entirely along normal lines, rather than on those laid down by Cuniberti.

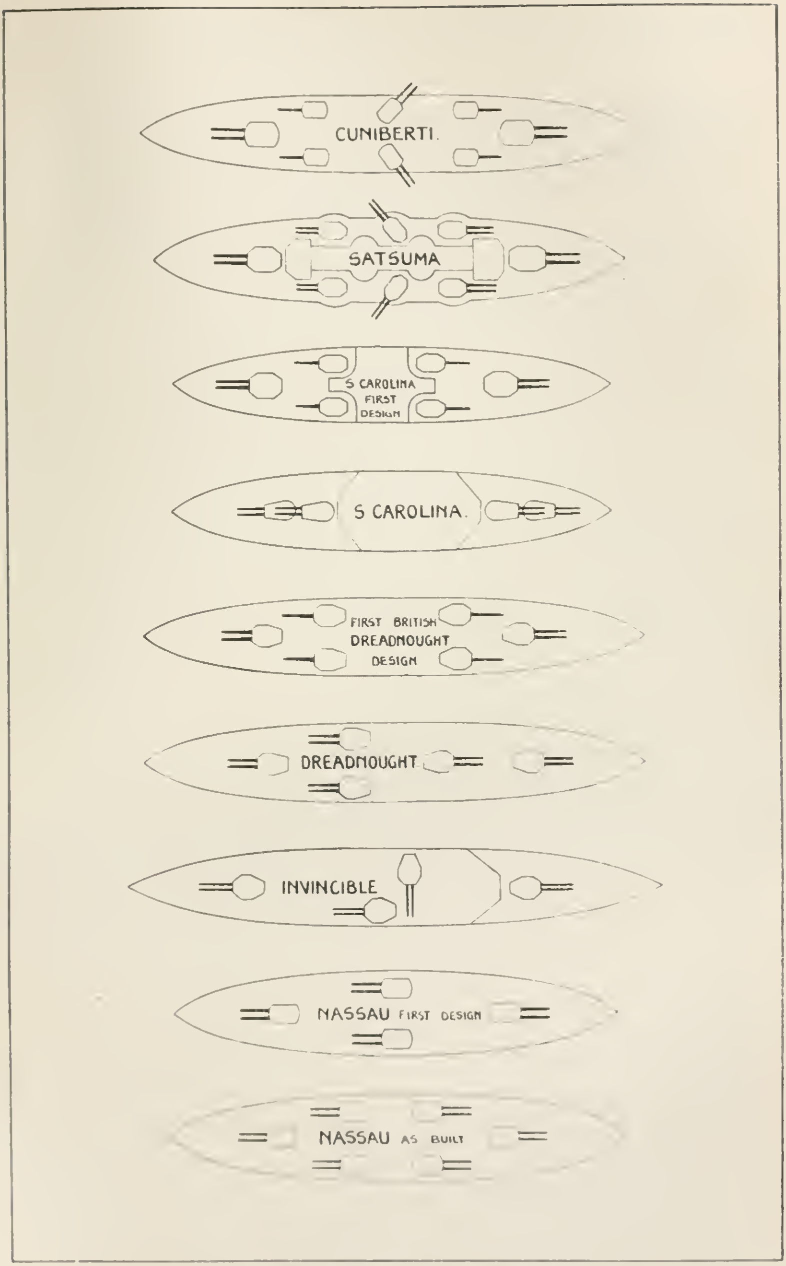
The table on the next page and diagrams indicate how the original Cuniberti idea compares with the first results obtained. It will be noticed that, except in the case of the *Invincible* type, and there only at a sacrifice of armour and armament, was, however, anything like the Cuniberti speed attempted. It should be stated that in the Cuniberti ship the peculiar " girder construction " of his *Vittorio Emanuele* was obviously contemplated. This construction, which admits of far lighter scantlings than usually employed, has not been attempted in any other Navies, and a corresponding extra dead-weight results.

Coming to details, there is uncertainty as to the exact original design of the *Satsuma;* but a uniform armament of big guns was certainly the first to be projected. It is not clear whether it was abandoned from a preference for a numerically larger but mixed battery; or with a view to utilising such guns as were most likely to be available for early delivery. Japan was then at war, and there was the natural anticipation that the ships might be wanted before the war was over. It should, on the other hand, be borne in mind that the *Kashima* and *Katori*, of 16,400 tons, carrying four 12-inch, four 10-inch, twelve 6-inch, and twelve 14-pounders, with 9-inch belts and 18.5 knot speeds were at that time held up in England on account of the war. Hence it has with some considerable show of reason been argued that the *Satsuma* and *Aki* are nothing but normal developments of the *Kashima* design, bearing just the same relation to it as the British *Lord Nelsons* bear to the *King Edwards*. It was also practically admitted by the Japanese at a

ORIGINAL DREADNOUGHT DESIGNS.

	Normal Displacement. Tons.	Armament.	Belt. in.	Des'd. Speed. Knots.	Laid Down.
Cuniberti (as built)	17,000	12-12in., 18-12 pdr.	12	24	*pro.* 1903
Satsuma Design	19,250	12 *or* 10-12in., 12-4.7	9	20	——
Satsuma	19,250	4-12in., 12-10in., 12-6	9	20	1905
S. Carolina, pro.	16-17,000	8-12in., (*or* 4-12in., 8-10in.), 30-14 pdr.	10	18-20	——
S. Carolina	16,000	8-12in., 22-14 pdr.	12	18½	1906
Dreadnought, 1st Design	?	10-12in.	..	..	——
Dreadnought (as built)	17,900	10-12in., 27-12 pdr.	11	21	1905
Invincible	17,250	8-12in., 16-4in.	7	25	1906
Nassau (as "S")	?	8-11in., 12-6in., 10-24 pdr.	?	19½	1906
Nassau	18,500	12-11in., 12-6in., 10-24 pdr.	9¾	19½	1907

Note.—The *Nassau* was delayed a year owing to alterations in design.



ORIGINAL DREADNOUGHT DESIGNS.

later date that for diplomatic reasons, in accounts of the contemporary armoured cruisers of the *Tsukuba* class, the armaments* were exaggerated.

Be all these things as they may, however, Japan is obviously entitled to some considerable share in originating the "Dreadnought movement."

The claims of the United States Navy rest on a stronger basis. The *South Carolina* type, all big guns in the centre line, all bearing on either broadside, was a distinct advance and novelty. The actual chronological date of laying down goes for nothing; the ships were designed and authorised long before they were commenced. No secrecy whatever was observed about them, and a strong body of opinion will always credit the United States with being the first Navy that definitely adopted the "all-big-gun idea." It is interesting to note (see table) that at one stage a mixed 12-inch and 10-inch armament was regarded as a possible alternative.

It has been claimed, either by those responsible for the *Dreadnought* herself, or by others professing to speak for them, that the *Dreadnought* was evolved entirely independently of Cuniberti's ideal. It is practically impossible to say definitely how far there can be any truth in this. In all Admiralties, ships are, as a rule, designed as "projects" long before they see the light (some never see it at all, as witness the sea-going masted turret-ship of his design referred to by Sir Edward Reed in some remarks quoted on an earlier page!). The first British all-big-gun ship design (see diagram) is a lineal enough descendant of the *King Edward* and *Lord Nelson*,

* These were announced as intended to carry four 12-inch and eight 10-inch, besides smaller guns. The 10-inch proved later on to be mythical.

just as Cuniberti's is a descendant of the *Vittorio Emanuele.*

The Cuniberti design appears, however, to have been submitted as early as 1901. In any case, to Cuniberti belongs the first clear exposition of the idea, while the ridicule with which it was at first received indicates the general novelty.

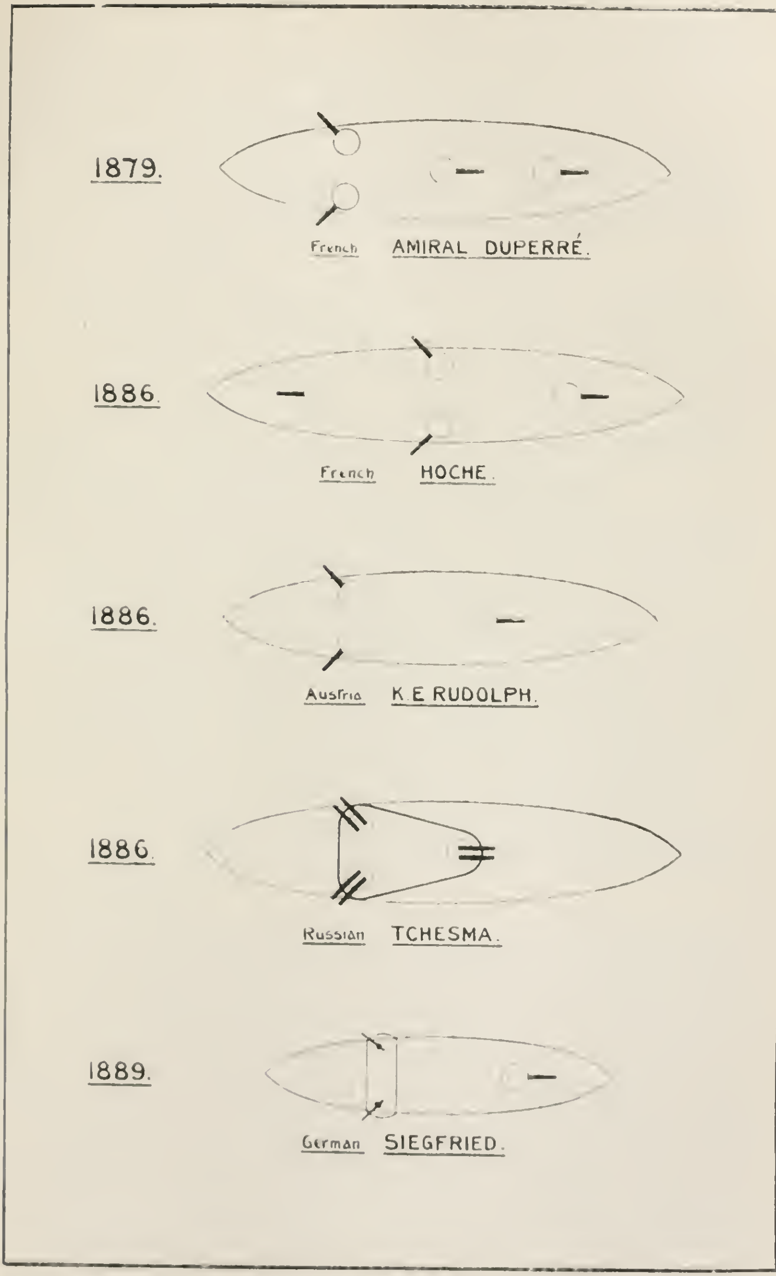
Germany is also a claimant to having evolved Dreadnoughts with the "*S*" type, intended to have been laid down in 1906, to follow the *Deutschlands.* These ships can hardly have been designed much later than 1904. When first heard of they were reported to carry four big gun turrets, of which two were placed on either side amidships. Six big guns was the first reputed armament, later each turret was to carry two guns.

The absurd secrecy with which subsequent German designs have been shrouded was not then in evidence; and all the indications are that the *Nassau,* as originally contemplated, was to have been a four-turret ship—the two extra 11-inch being Germany's equivalent for the four 12-inch, four 9·2, of our *King Edwards.* This would perhaps accord Germany a priority in actually adopting the principle of an increased number of heavy guns.

All of which suffices to indicate that the adoption of more than four big guns had little or nothing to do with the somewhat theatrical building of the original *Dreadnought.*

On the other hand (with the possible and doubtful exception of the *South Carolinas**) it appears clear that the *Dreadnought* was the first ship in which the all-big-gun principle was adopted as a technical asset in gun-laying over and above guns *qua* guns. After four, eight was

* American scientific gunnery rather post-dates the *South Carolina* design.



EARLY EXAMPLES OF WING TURRETS.

the "tactical unit" of guns, promising results altogether out of proportion to anything that six, or for that matter, ten (in proportion) could achieve.

It may not be too much to say that what Cuniberti "saw as through a glass darkly," the *Dreadnought* translated into fact, and that she was the first battleship avowedly so designed.

"Fire control" was a new thing in 1905. No navy, save the British, had considered it to any appreciable degree. The *King Edwards* had taught that control of two calibres from one position was a practical impossibility. Mixed calibres were damned accordingly, and there was no outlet but the *Dreadnought.*

But for Cuniberti she might, and possibly would, have remained a theoretical desirability for several more years. The measure of his genius may be the demonstration that such an ideal ship could be built. It is to be argued that he did nothing more than put into practicable shape what already existed as a hypothesis. Even so, however, to him belongs the honour of indicating that the step from theory to practice was possible; and on that account alone he deserves to go down to posterity as the actual creator of Dreadnoughts.

In the other three ships of the 1905-06 programme, however, a high speed was accepted as the governing factor. The ships as built were designated "armoured cruisers," and in so far as the Japanese were known to be building armoured cruisers carrying battleship guns, that designation was legitimate. For that matter, there also existed a paper by Professor Hovgaard, of the Massachusetts School of Naval Architecture, in which it was tentatively laid down that the ideal armoured cruiser of the future would be a battleship in armament and armour, increased in size, to obtain greater speed.

The three companion ships to the *Dreadnought*—the *Invincible*, *Inflexible*, and *Indomitable*—adhered no more closely to the Hovgaard ideal than to the Cuniberti one. In principle they varied from the *Dreadnought* design only in that they sacrificed a certain amount of armour in order to obtain a greater speed. By the adoption of the échelon system, the same broadside-fire was secured for them (on paper, at any rate) as for the *Dreadnought*, though with a turret less. In practice it has been found that there are very few positions in which they can bring more than six big guns to bear, but this must be considered as an error of construction rather than of principle. They have turned out to be wonderful steamers, but considerably inferior sea-boats to the *Dreadnought*, and in the British Navy are generally likely in the future to become regarded as obsolete long before the former. For all that, they probably approximate more nearly to the warship of the future than the *Dreadnought*.

Admiral Bacon, in his views as to the warship of the future, generally inclined to the idea of very large and very swift ships, relying on armament, speed, and super-scientific internal sub-division rather than on armour protection. These ships would act more or less independently, each, as it were, representing a divided squadron group of to-day.

It is interesting to note that Italy, which in the seventies evolved in the *Duilio* and *Dandolo* the "Dreadnought" of that period, eventually developed a very similar idea in the *Italia* and *Lepanto*, which had no side armour whatever. In later designs a thin belt was reverted to, and finally the old cycle was resumed.

This result was brought about by the quickfirer, which appeared as a rival to the hitherto predominant monster gun. To-day the torpedo is becoming paramount and a danger to a fleet in close order at almost any range —hence the Bacon ideal. It remains to be seen whether the future will produce any analogy to the cycle of the quickfirer of the eighties.

Details of the *Invincible* type are :—

Displacement—17,250 tons.

Length (over all)—562ft. (*p.p.*, 530ft.).

Beam—78½ft.

Draught—29ft.

Armament—Eight 12-inch, XI, 45 calibre, sixteen 4-inch (model 1907) ; three submerged tubes.

Armour Belt—7-inch, reduced to 4-inch at the ends.

Machinery—Parsons Turbine.

Horse-power—41,000=25 knots.

Boilers—(*Invincible* and *Inflexible*) Yarrow, (*Indomitable*) Babcock.

Coal—(normal) 1,000 tons; (maximum) 3,000 tons ; oil fuel also.

Builders—(*Invincible*) Elswick, (*Inflexible*) Clydebank, (*Indomitable*) Fairfield.

Engined—(*Invincible*) Humphrys, (*Inflexible*) Clydebank, (*Indomitable*) Fairfield.

As originally designed, the anti-torpedo guns of these ships would have been the same as the *Dreadnought's*, but, having been completed nearly two years later and a new pattern 4-inch quickfirer having been invented in the interim, they were fitted with these guns. The trial results were as follows :—*Invincible*, 26.6 knots ; *Inflexible*, 26.5 knots ; and *Indomitable*, 26.1 knots ;

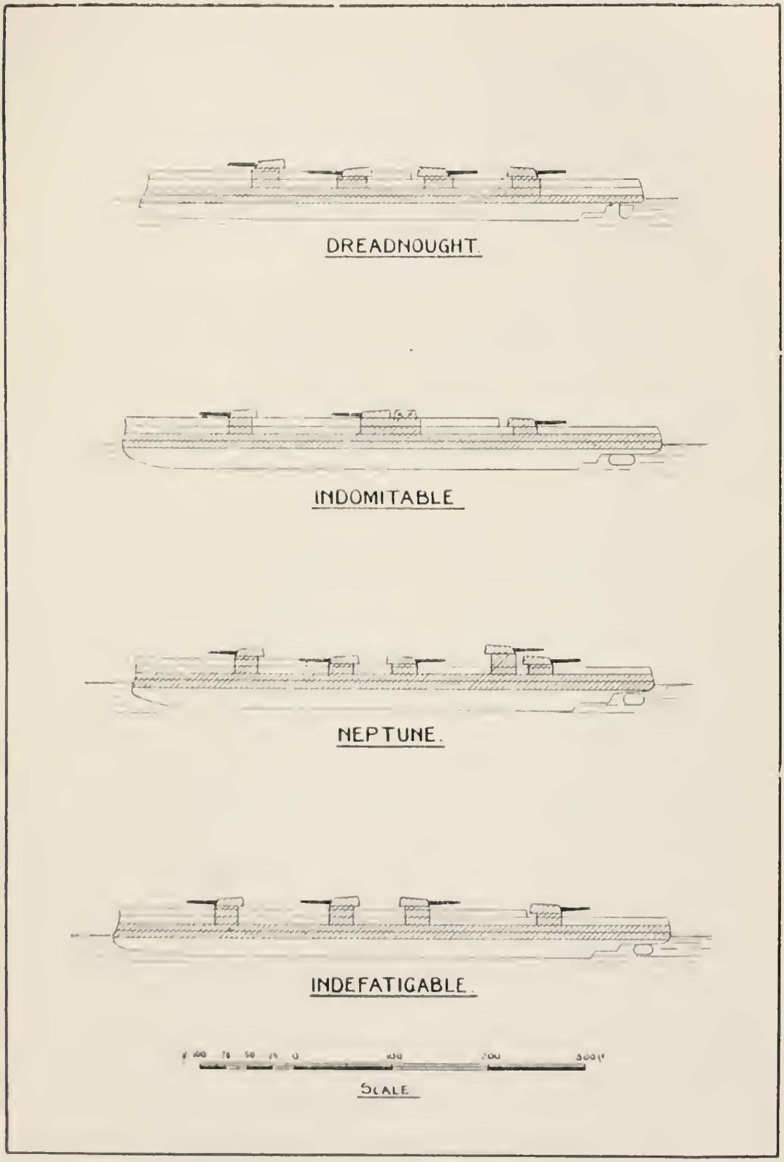
the designed horse power being considerably exceeded in every case. After they were commissioned and had shaken down, these trial speeds were considerably exceeded, and at one time and another they all did well over 28 knots; the *Indomitable* having made a record of 28.7.

The fuel consumption of these ships is naturally enormous. The *Indomitable*, in crossing the Atlantic at full speed, burned about 500 tons of coal a day, as well as about 120 tons of oil. As steamers they are to be considered remarkably successful. The average cost of construction was about £1,752,000, which works out at a little under £102 per ton.

Towards the close of the year 1911 the official designation of "armoured cruiser" for them and similar ships was abandoned, and the term "battle cruiser" substituted. No further secret was made of the fairly obvious fact that they were designed as "fast battleships," intended to engage and hold a retreating enemy till such time as the main squadron could come up.

Curiously enough, for some while, though every nation started building *Dreadnoughts*, Germany alone proceeded to build *Invincibles* also. In 1911 Japan ordered a ship of fast battleship type; but, generally speaking, foreign nations have abstained from embodying this portion of the Cuniberti ideal in their designs.

The programme for the years 1906-07 had been originally intended to include the building of four armoured ships, presumably one *Dreadnought* and three *Invincibles;* but the Liberal party, which had just come into power, modified this to three battleships of an improved *Dreadnought* type. This action led to a popular agitation which ultimately eventuated in the



DREADNOUGHTS.

provision of no less than eight armoured ships in the estimates of three years later.

The three ships which followed, the *Dreadnought*, the *Bellerophon*, *Téméraire*, and *Superb*, are some seven hundred tons heavier, but otherwise differ only in minor details. For the one heavy tripod of the *Dreadnought*, two were substituted, and the 4-inch anti-torpedo gun was also mounted. In the next year the *St. Vincent* class, a group of similar type, but increased by 650 tons, were provided. The anti-torpedo armament is carried to 20 guns in the *St. Vincent* class, which are 10ft. longer than their predecessors, and carry fifty-calibre big guns in place of the forty-five calibre pieces of the earlier ships. The constructive particulars of these ships are as follows :—

Name.	Built at.	Machinery by.	Laid down.	Completed	Trials.
Bellerophon .	Portsmouth	Fairfield	Dec., '06	Feb., '07	21.9
Téméraire . . .	Devonport	Hawthorn, Leslie	Jan., '07	May, '09	——
Superb	Elswick	Wallsend Co.	Feb., '07	June, '09	——
St. Vincent . .	Portsmouth	Scott Eng. & S. Co.	Dec., '07	Jan., '10	21.9
Collingwood .	Devonport	Hawthorn, L.	Feb., '08	Jan., '10	22
Vanguard . . .	Vickers	Vickers	April, '08	Feb., '10	22.1

In the Estimates for 1908-09, the armoured ships provided were reduced to two, the *Neptune* and the *Indefatigable*. Provision in the United States, Argentine, and Brazilian Navies for ships bearing ten big guns on the broadside and the prospect of ships with equal broadsides being constructed elsewhere is presumably the reason why in the *Neptune* the original *Dreadnought* design was varied, and a new arrangement of turrets introduced. The *Neptune*, which is of 20,200 tons, is a species of compromise between the *Dreadnought* and *Invincible* designs, the amidship guns being *en échelon*, and so mounted that they give a very full arc of fire on either broadside. The increased space occupied by this arrangement necessitated a certain cramping aft, for which reason the forward of the two after turrets was superposed to train over the aftermost, American fashion.

Particulars of the *Neptune* are as follows :—

Displacement—20,200 tons.
Length (over all)—546ft.
Beam—85 ft.
Draught—29ft.
Guns—Ten 12-inch, fifty calibre, twenty 4-inch.
Armour—Belt 12-in. amidships, 6-in. forward, 4-in. aft. Lower deckside, $9\frac{3}{4}$-in. Turrets, 12—8-in.
Machinery—Parsons Turbine.
Horse-power—25,000=21 knots.
Boilers—Yarrow.
Coal—(normal) 900 tons ; (maximum) 2,700 tons ; oil fuel also.
Built at Portsmouth Dockyard.
Engined by Harland and Wolff.

On trial she developed at three-quarter power I.H.P. 18,575, with a speed of nineteen knots, and at full power 27,721, with 21.78 knots. Her best maximum spurt speed was 22.7—that is to say, about one and three-quarter knots over contract.

In the *Neptune* the original *Dreadnought* practice of mounting the anti-torpedo armament on top of the turrets was entirely abandoned, and these guns were placed inside or on top of the superstructure in three main groups.

The number of torpedo tubes was reduced to three, the reason for this being partly to save space and also

"INDEFATIGABLE" AND "INVINCIBLE"—1911

to take advantage of improved methods for securing rapidity of fire. In the *Neptune* the possibility of aero craft first received consideration, the upper deck being built sufficiently thick to be proof against bombs dropped from aloft.

The *Neptune* was one of the cheapest ships ever built for the British Navy, her cost working out at a little under £87 per ton.

The other ship of the same programme was the *Indefatigable*, an improved *Invincible*. She represents an increase of nearly 2,000 tons over the type ship, with an increase in length of 18ft. and a foot more beam. Save for the addition of four more anti-torpedo guns the armament remains the same, but an extra inch is added to the belt. The principal improvement achieved in her is that the two amidship turrets are much less crowded up than in the type ship, thus securing a considerably better range of fire.

Although the horse power is proportionately less than that of the *Invincibles*, the better lines of the ship have made her even more speedy. She easily exceeded her designed speed on trial, and has reached as high as 29.13 knots.

The cost of construction was £1,547,426, which works out at about £82 10s. per ton, as against the average £120 per ton that the *Invincibles* cost to build. She was the cheapest ship ever built for the British Navy,* to her date.

Details of the *Indefatigable* are :—

Displacement—19,200 tons.

Length—578ft.

Beam—79½ft.

* It should be remembered that alterations were made in the *Invincible* class in the course of construction, and this probably helped to swell the cost.

Draught—27¾ft.

Guns—Eight 12-inch, fifty calibre, twenty 4-inch.

Armour Belt—8-in. amidships, diminished to 4-in. at the ends.

Machinery—Parsons Turbine.

Horse-power—43,000=25 knots.

Boilers—Babcock.

Coal—(normal) 1,000 tons; (maximum) 2,500 tons; oil fuel also.

Built at Devonport Dockyard.

Engined by J. Brown & Co., of Clydebank.

Two other battle-cruisers almost identical to the *Indefatigable*, the *Australia* at Clydebank, for the Australian Navy, and the *New Zealand* at Fairfield, a gift from New Zealand to the British Navy, were launched in 1911.

The programme for 1908-09, consisting as it did of only two armoured ships, and the fact that the corresponding German programme was increased by one capital ship, bringing the total to four, brought the naval agitation to a head. Meetings demanding eight "Dreadnoughts" were held all over the country, with the result that the British programme for 1909-10 rose to four armoured ships with four other "conditional" ships. The ships of the former programme were the *Colossus*, *Hercules*, *Orion*, and *Lion*, and the first two of these were laid down some months before the usual date, the *Colossus* being commenced in July instead of at the end of the year.

The "conditional" ships were all eventually laid down in April of the following year. They were the *Monarch*, *Conqueror*, *Thunderer*, and *Princess Royal*.

Under this programme there were no less than three distinct types of ships. The first two, the *Colossus* and

Hercules, are practically sisters of the *Neptune*, but of 400 tons greater displacement. They differ in appearance in having but one tripod mast instead of two. This, like the *Dreadnought's*, is placed abaft the foremost funnel. The *Colossus* was built and engined by the Scott Shipbuilding and Engineering Co., commenced in July, 1909, and completed two years later. The *Hercules*, built by Palmer's, followed a month later in both cases. The first is fitted with Babcock, and the second with Yarrow boilers. A point of minor interest about these two ships is that whereas the anti-torpedo armament of the *Neptune* is in three groups, that of the *Colossus* and *Hercules* is in two groups only, the mounting of small guns between the échelon turrets being done away with.

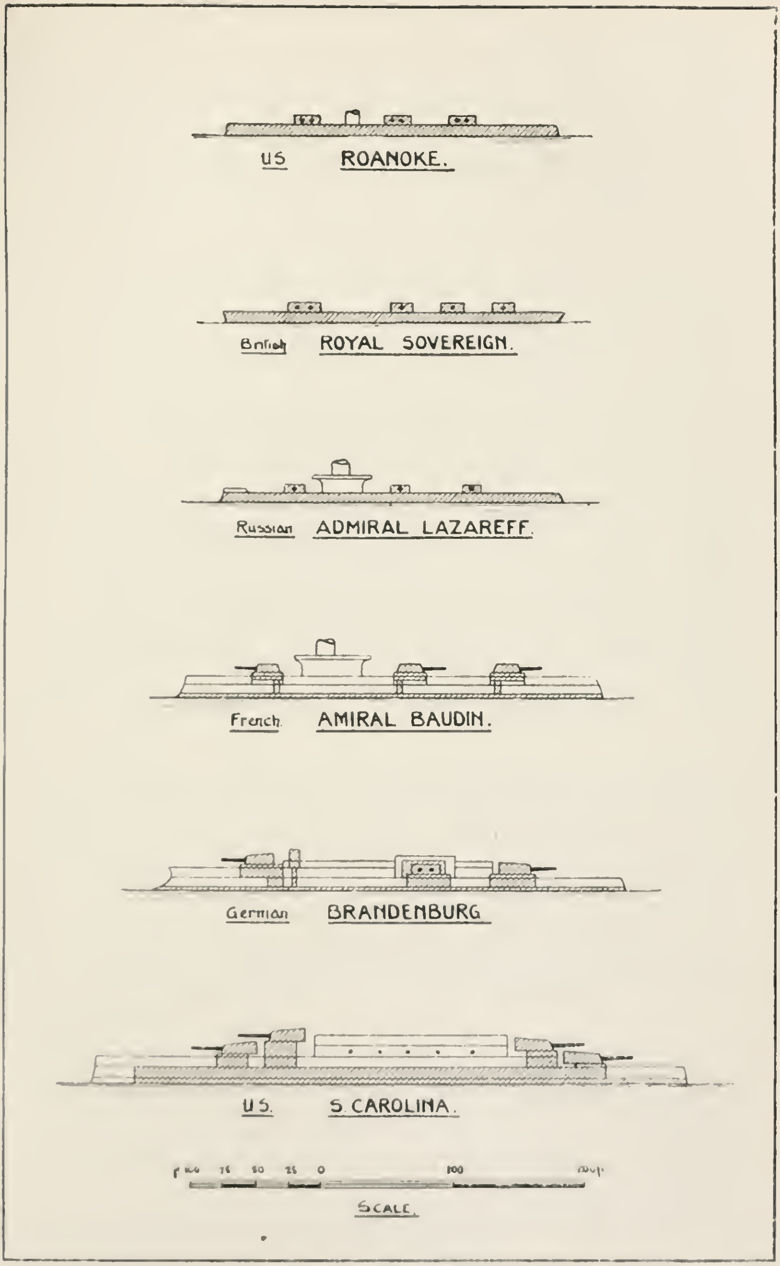
The other two types of the 1909-10 Estimates are the ships generally known as " super-Dreadnoughts."

SUPER-DREADNOUGHTS.

The most obvious feature of the so-called " super-Dreadnoughts " is the introduction of the 13.5-inch gun, particulars of which will be found at the end of this chapter. This gun was experimented with with a certain amount of secrecy, and was for a long time officially designated as the 12-inch " A," although practically everybody knew that it was really a 13.5. It was only rendered possible by recent improvements in gun-mountings and gun-construction. It is not very appreciably heavier than the latest type of 12-inch, as mounted in the *Colossus*, and its adoption was not so much a matter of obtaining an increased range and penetration, as of securing the tremendously increased smashing power of the heavier projectile.

Somewhat less obvious to the general public, but really of a great deal more far-reaching importance, is the "Americanising" of British naval design exhibited in all the "super-Dreadnoughts." Though differing in detail, the arrangement of the armament in all the "super-Dreadnoughts" followed the American centre-line system, an interesting indication of the progress of the United States Navy from the days, not so very long ago, when American warship design was more or less a *pour faire rire!* It is none the less interesting from the fact that in the earliest designs, in all ships carrying more than two turrets, the centre line was the only arrangement ever built or even considered. Yet when an increased number of turrets came into being, the American Navy was the only one which followed the original practice. In all other Navies ideas of the period 1870-1880, when strong end-on fire was considered an all-important essential, influenced design. America alone appreciated the prophecy long ago made by Admiral Colomb to the effect that whatever else might temporarily obtain, broadside to broadside would always be reverted to for battle, on the grounds that thus, and thus only, could the maximum number of guns be utilised.

It is proper here to remark that though the Americans adopted the centre line from the outset for practical reasons, this disposition became more or less a necessity when 13.5's came in, owing to the infinitely greater strain on the structure. This has been occasionally used as an argument against American influence having made itself felt, but the balance of evidence shows that even had the 13.5-inch not appeared, the centre line system would have figured in the Navy. The original centre-line idea disappeared because the échelon system looked so superior. The échelon system of the 1875-85 era,



CENTRE LINE SHIPS OF VARIOUS DATES.

however, died out in its turn on account of certain practical disadvantages. It was resurrected when these had been forgotten in the lapse of years; but the disadvantages entailed in firing across a deck soon made themselves felt again once the system was reverted to.

One of the earliest advocates, if not the first of modern advocates, of the centre-line in England was Admiral Hopkins. Discussing the original Cuniberti ideal, Admiral Hopkins pointed out that although for an absolute right-ahead or astern fire wing-turrets gave an advantage, a very slight yaw entirely altered the proportion, and that circumstance in which the enemy was dead right-ahead necessitating such a yaw were likely to occur very rarely indeed in war. He leaned, therefore, to the opinion that a fewer number of guns all in the centre line would be equally as efficacious, practically, as a larger number disposed partly in wing turrets.

The échelon system, of course, renders practically no assistance here, the arc of the guns firing across the deck being necessarily restricted, even with the best échelon arrangement. While, therefore, the échelon system is good for absolute end-on, or for more or less absolute broadside firing, any intermediate and more probable position renders it less efficient than a centre-line arrangement.

Another defect of the échelon system is that with it, except exactly end-on, one side of the ship is necessarily more efficient than the other, and that this is reversed according to whether the enemy is ahead or astern, twenty-five per cent. of the big-gun armament being affected thereby in a four turreted ship.

Though attention never seems to have been drawn to the matter, it is a fact worthy of some attention that the *Von der Tann,* which is to be regarded as Germany's "answer" to the *Invincibles,* has (like all German* ships on the same system) her échelonned turrets exactly in reverse order to British ones. All British ships have the port turret foremost; all German ones the starboard. The net result of this is that (as the diagram indicates) there are two worst and two best positions for either design. An *Invincible* getting and keeping a *Von der Tann* upon her starboard bow or port quarter would have a twenty-five per cent. superiority over her, while, supposing the German type to maintain a position on her starboard quarter or port bow she would be to the same extent over-matched, and to a certain extent "in chancery."

With the centre line system, the imposition of fighting one side rather than the other is not imposed, and overhauling or being overhauled causes no disadvantage. Nothing is lost, save in the almost hypothetical case of two ships engaging exactly end-on—a condition which in no case would endure for more than a very short space of time, to say nothing of the fact that practically all gunnery errors being of "elevation" and not of "direction," a ship adopting the end-on position offers the equivalent of a vertical target of some 60ft. to 70ft. instead of the equivalent of 30ft. or so that she would present broadside on.

The centre-line system may, therefore, be expected to endure against all other dispositions pending the

* In the Chinese ships *Ting Yuen* and *Chen Yuen,* built in Germany in 1882 with big guns *en échelon,* the former had the port big guns foremost, the latter the starboard ones—presumably an appreciation of and an attempt to overcome the inherent defect of the échelon system—the two ships being intended to fight in company, and so have one of the two always in the best fighting position were the enemy anywhere on the beam or quarter.

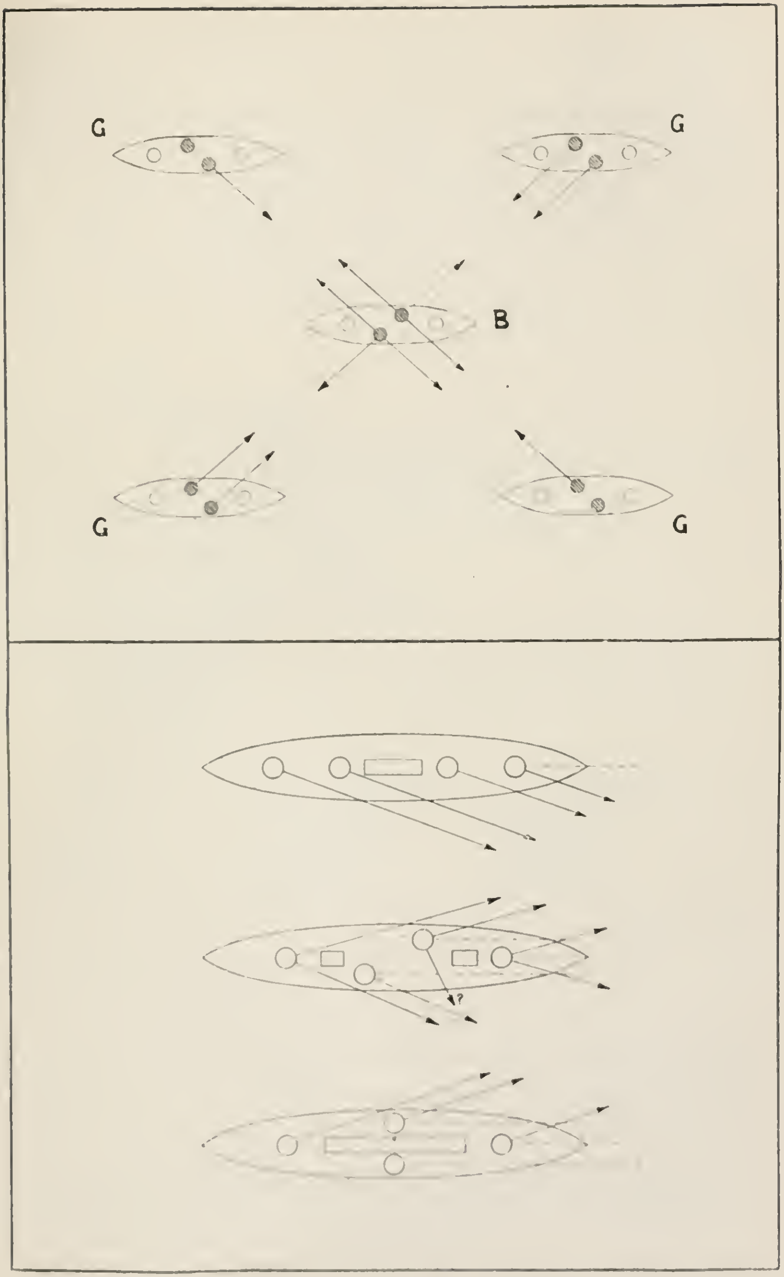


DIAGRAM TO ILLUSTRATE WEAK POINT OF THE ECHELON SYSTEM.

appearance of some fresh condition of affairs which would cause the old end-on idea to be reverted to.*

The *Orion* was the only one of her class which belonged to the normal Estimates, 1909-10, the other three—*Conqueror, Thunderer, Monarch*—being "contingent ships." Details of the class are as follows:—

Displacement—23,500 tons.

Length—(between perpendiculars) 554½ft; (over all) 584ft.

Beam—88½ft.

Draught—(mean) 27¾ft.

Armament—Ten 13.5-inch, forty-five calibre; sixteen 4-inch; three 21-inch torpedo tubes.

Armour Belt—12—4-inch. Turrets, 12-inch.

Machinery—Parsons turbine.

Horse-power—27,000=21 knots.

Boilers—Babcock.

Coal—(nominal) 900 tons; (maximum) 2,700 tons; oil, 1,000 tons.

Name.	Built at.	Engines by.
Orion	Portsmouth	Wallsend Co.
Conqueror	Beardmore	Beardmore
Thunderer	Thames I.W.	Thames I.W.
Monarch	Elswick	Hawthorn

The *Orion* was laid down in November, 1909, the others in April, 1910.

The *Orion* was the first of these ships to be commissioned, and her gunnery trials were watched with great interest. Few details of them transpired, save that part of the secondary battery was injured by blast.

* The torpedo, for example, may possibly bring about something of the sort by a state of speed and accuracy which leads to heavy or anticipated heavy long-range losses from it in fleet actions. To offer only one-fifth or so of the target would then be a serious consideration.

After commissioning, the *Orion* was sent for a voyage across the Bay of Biscay, and attracted much attention by rolling very heavily, this being attributed to the fact that her bilge keels were not large enough—not to any general structural defect.

An interesting feature of the *Orion* type is that in it provision first appears for the protection of boats in action.

Belonging to the same programme (1909-10), the first belonging to the normal Estimates and the second to the "contingent," are the battle cruisers *Lion* and *Princess Royal.* A great deal of secrecy was observed about these ships, but their main details are approximately as follows:—

Displacement—25,000 tons. Full load, 26,350 tons.

Length—(water-line), 675ft.; (over all) 690ft.

Beam—86½ft.

Draught—(maximum) 30ft.

Armament—Eight 13.5 inch 45 calibre, twenty 4-inch, three 21-inch torpedo tubes.

Armour—Belt, 9—4-inch.

Machinery—Parsons Turbine.

Horse-power—(as designed)=28 knots.

Boilers—Yarrow.

Coal—(normal) 1,000 tons; (maximum) 3,500 tons; oil also.

Lion—Built at Devonport; engined by Vickers.

Princess Royal—Built at Vickers'; engined by Vickers.

The *Lion* was laid down in November, 1909, and launched in the following year. The *Princess Royal* was laid down in April, 1910, and launched a year later. Both were arranged to be completed during 1912.

The *Lion* was somewhat delayed owing to slight repairs being required to her turbines. In addition, the authorities very wisely did not "hurry" her—hurrying ships to fit an exact official date having done more mischief than anything else in the past.

The *Lion* did her trials early in 1912, and reached a maximum of 31.7 knots by patent log, with a mean of 29 knots at full power and 24.5 or so at three-quarter power. For her trials the *Lion* burned coal only, and this at the seemingly enormous rate of 950 tons a day, which worked out at approximately about a ton and a quarter per mile. This consumption, heavy though it seems, really pans out at about the usual "ton a mile," as the ship developed horse-power far in excess of the contract. At the same time it necessarily draws attention to the enormous increase in coal stores required for supplying modern warships. It is unfortunately by no means clear that the question of the very great increase in coal required for modern warships has been thoroughly realised by the authorities. The amount provided may be said to be what ships needed in the pre-Dreadnought era. It is now an open secret that at the time of the "war scare" with Germany in 1911, the British Home Fleet was unable to proceed to sea owing to a shortage of coal supply, many ships being a thousand tons short and no proper arrangements for rapid remedy existing. This state of affairs, at one time alleged to be merely a newspaper *canard*, is not likely to occur again; but it is an indication of how difficult it is adequately to realise the problem of coal supply to ships of ever-increasing horse-power.

During the *Lion's* trials it was found that the heat from the fore funnel was so great that the fire-control

J

station (then carried on a tripod mast placed immediately over the forward funnel) was so intense as to render that position practically impossible. On the navigating bridge also, instruments were badly affected by the heat. The ship was consequently further delayed in order to effect essential modifications. These included the abolition of the tripod mast, shifting the fore funnel back a long way, and enormously increasing the height of all funnels.

The principal item of the Estimates of 1910-11 was five armoured ships. Of these, four, the *King George V* class, are slightly improved replicas of the *Orion*, while the remaining vessel, the *Queen Mary*, is a battle-cruiser of the *Lion* type.

Ships of the *George V* class are as follows :—

Name.	Built at.	Machinery by.
King George V	Portsmouth Y.	Hawthorn
Centurion	Devonport Y.	Hawthorn
Ajax	Scotts	Scotts
Audacious	Cammell-Laird	Cammell-Laird

The over-all length is increased to 596ft., and the horse-power to 31,000. All were laid down during 1911, with a view to launching during 1912 and completion in 1913. The displacement of these ships is 23,000 tons odd.

The *Queen Mary,* laid down at Palmers' early in 1911, and engined by Clydebank, is virtually a sister to the *Lion,* differing from her merely in a slight variation of the lines, and some increase in length. Save for these items, and a small difference in the arrangement of the anti-torpedo armament, the ship belongs to the same class and type.

The 1911-12 Estimates provided for five further large armoured ships, which represent an increase in dimensions over their predecessors. Of these the first four are battleships varying from their predecessors in the inevitable increase in size to allow of somewhat superior protection and an improved secondary battery—twelve 6-inch being substituted for the sixteen 4-inch of the *King George* class.

The selection of the 6-inch gun as the anti-torpedo craft weapon was due partly to the way in which Germany had persisted in her rigid adherence to that calibre for her minor armament, and partly to the rapidly increasing size of destroyers. It was held as questionable, even by the most ardent believers in the ability of the big ship to defend herself against destroyer attack, whether the 4-inch was sufficient to disable large destroyers. Hence the adoption of the 6-inch—the largest gun that can be man-handled.

The nominal displacement of these battleships, the *Iron Duke* class, rises to 25,000 tons as against 23,000 of the previous class. The length is increased to 620ft. and the beam to 89½ (instead of 89ft.). Owing to improved lines, the horse-power is reduced to 30,000 without any very material loss of speed. In all these super-Dreadnoughts, as in the Dreadnoughts themselves, 21 knots has always been the selected speed, though in units there have been slight variations.

Ships of the *Iron Duke* class are as follows :—

Name.	Built at.	Machinery by
Iron Duke	Portsmouth Y.	Cammell Laird
Benbow	Beardmore	Beardmore
Emperor of India..........	Vickers	Vickers
Marlborough	Devonport Y.	Hawthorn

The *Emperor of India* was originally named *Delhi*. The first two were given Babcock, and the second two

Yarrow boilers. All were completed in 1914, but only the *Iron Duke* was available for service on the eve of the outbreak of the war with Germany and Austria. The other three were, however, rapidly completed and put into commission.

The fifth ship of the 1911-12 Estimates was the battle cruiser *Tiger*, nominally belonging to the *Lion* group, but actually differing very considerably in various important details.

She was laid down at Clydebank in June, 1912, a great deal of official reticence being maintained concerning her. She was not complete on the outbreak of war; but as she was available for service not long afterwards she is included in this survey.

The marked and most characteristic difference between her and the *Lions* is that the third turret instead of being cramped amidships as in the *Lion* design, is moved further aft, thus giving a greatly improved arc of fire. Twelve 6-inch were substituted for the sixteen 4-inch of the *Lions* for reasons already given.

The *Tiger* is approximately 720ft. long, with a nominal horse-power of 75,000. Babcock type boilers are fitted. Her nominal speed is 27 knots, but this has more than once been very considerably exceeded.

For 1912-13 the Estimates provided for four capital ships, the usual twenty destroyers, and a new type of warship designated as "lightly armoured cruisers."

This programme is of abounding interest, not only on account of the fact that—so far as the larger types of ships are concerned—it probably embodies the last new construction available for the British Fleet in the war (unless the war endure beyond all anticipations) but also because of its more or less revolutionary nature.

EARLY "30 KNOT" DESTROYERS.

The big ships of the programme were as follows :—

Name.	Built at.	Machinery by.
Queen Elizabeth	Portsmouth Yard	Wallsend
Warspite	Devonport Yard	Hawthorn
Valiant	Clydebank	Fairfield
Barham............	Fairfield	Fairfield
Malaya	Elswick	Wallsend

The fifth ship in this list, the *Malaya*, is an extra vessel paid for and presented to the British Navy by the Federated Malay States.

In general appearance these ships of the *Queen Elizabeth* class do not greatly differ from their predecessors ; but there all resemblance ends. In every other way they embody a "new idea"—an attempt so to blend the battleship proper with the battle-cruiser so as to secure the best points of both.

Roughly, the battleship proper sacrifices speed for extra gun power and protection ; while the battle-cruiser sacrifices these two latter for speed. The speed of the *Queen Elizabeths* was fixed at 25 knots—something rather less than that of battle-cruisers, but still sufficiently high to take them out of the ordinary battleship category as hitherto understood. Certainly they differ from the normal quite as much as the original *Dreadnought* differed fron her immediate predecessors.

It was only possible to secure this high speed, plus other qualities, by the bold adoption of oil fuel only—in itself of the nature of a gigantic experiment, which, however, results have more than justified. The designed horse-power to secure 25 knots is 58,000.

If, however, the motive power embodied novelty, still more so did the armament. For the ten 13.5's of preceding ships, eight 15-inch guns were substituted. So far as power is concerned the 13.5 is ample for all contingencies, but the 15-inch embodies a marked superiority in range and the additional accuracy which a heavier projectile naturally affords. Furthermore—a very important point—the "life" of the 15-inch gun is much longer, owing to there being no necessity to utilise the full power of which it is capable.

The general arrangement of turrets is that of all the super-Dreadnoughts, with the middle turret (always the most restricted in arc of fire) omitted.

Nothing has ever been officially stated as to the armour protection; but it is known to be equal or superior to that of any preceding battleships.

When war broke out, the first two of these ships were nearing completion—the first being completed about the end of 1914 and the second at the end of March, 1915.

The 1913-14 Estimates provided for five more or less normal battleships designed for coal fuel,* the usual 21 knots speed, but 15-inch instead of 13.5-inch guns.

Name.	Built at.	Machinery by.
Royal Sovereign	Portsmouth Y.	(not stated)
Royal Oak	Devonport Y.	do.
Resolution	Palmer	Palmer
Ramillies	Beardmore	Beardmore
Revenge	Vickers	Vickers

Beyond that they are of 25,750 tons, and were designed for 31,000 horse-power, no details of these ships have been furnished. Two were estimated to be completed by the end of 1915—the others in 1916.

* This is rumoured to have been abandoned for oil fuel.

The rest of the programme consisted of eight more lightly armoured cruisers, a reduced number of destroyers and an increased number of submarines.

In the 1914-15 Estimates three more battleships of the *Royal Sovereign* class—to be named *Renown, Repulse,* and *Resistance*—were provided for, also a sixth ship of the *Queen Elizabeth class,* which was provisionally named *Agincourt.* The participation of any of these in the war is very improbable.

The other vessels of the programme were four lightly armoured cruisers, twelve destroyers and an unstated number of submarines.

When war broke out three battleships building in British Yards—two for Turkey and one for Chili—were taken over by the British Admiralty. Details of these are as follows :—

Name.	Displacement.	Armament.
Agincourt (ex-*Sultan Osman I*)	27,500	14—12in., 20—6in. ; 3 tubes.
Erin (ex-*Sultan Rechad V*).....	23,000	10—13.5, 16—6in. ; 3 tubes.
Canada (ex-*Almirante Latorre*) ...	28,000	10—14in., 16—6in. ; 4 tubes.

There were also taken over three Brazilian armoured gunboats—renamed *Humber, Severn,* and *Mersey*—of 1,200 tons each, carrying two 6-inch guns forward and two 4.7-inch howitzers aft. The speed is about 11½ knots, and early use was made of these vessels on the Belgian coast shortly after the outbreak of war.

In addition to the above, two large Chilian destroyers building at Cowes were taken over and renamed *Broke* and *Faulknor.*

A variety of other vessels were likewise incorporated into the British Fleet, liners (to act as auxiliary cruisers), trawlers (to act as mine sweepers), plus various hospital ships, transports, and so on and so forth. Roughly, from 25 to 33 per cent. of the British Mercantile Marine came to be used in some way or other by the Admiralty—to say nothing of innumerable private yachts and motor boats.

The destroyers of the period have not materially differed from their predecessors of the Dreadnought era, save for the adoption of two, and subsequently three, 4-inch guns in the armament, instead of one.

Submarines and aerial craft are dealt with in a separate chapter.

* * * * *

At and about the year 1912, the "super-Dreadnought" may be said to have reached its apotheosis.

For what it is worth, however, it may here be put on record that junior opinion in the Navy was then becoming opposed not only to "super-Dreadnoughts" but to Dreadnoughts in any shape or form. Hardly any naval officer under the rank of Commander, and an ever-increasing percentage over that rank, was to be found who was not more or less convinced that the days of the Dreadnoughts and "super-Dreadnoughts" might be nearly numbered, and that we were possibly on the verge of some as yet indeterminate revolution in naval construction as great as any that the "fifties" saw.

As yet no very clear argument can be produced. Only vaguely it is put forward that with torpedo range what it is, the big ship's chance against torpedo craft is practically relegated to not being found, and "not being found" depends mainly upon the "super-

Dreadnought" being screened with very numerous smaller craft.

When Lord Charles Beresford put it on record that a hundred anti-torpedo attack guns would be useless in a battleship, he spoke for all progressive naval ideas. A destroyer may be hit and hit vitally, but it is hard to imagine a hit which will stop her drifting within easy range of her quarry before going down. If hostile destroyers get in, the only real chance of big ships is to sweep their decks with the modern variant of "case shot" and so kill the crews, a difficult proposition at the best owing to the small amount of time available. The proposition is rendered tenfold harder by the certainty that attack, if it comes, will not come from one quarter only, but from several. Consequently to preserve the Dreadnoughts, an ever increasing number of auxiliaries is demanded. Of these no Navy can be said to have a sufficiency. Hence it is argued that a destroyer attack is bound to succeed sooner or later, while even did a sufficiency of small craft exist, the big ship has to be so nursed and protected that her sphere of usefulness is enormously reduced. Submarines also are a deadly danger.

On the other hand it is argued that, given sufficient bulk to the big ship, torpedoes are likely to be relatively harmless to her; it is also asked how can the small craft protect their own big ships and also search out and attack the enemy's mastodons?

There, till the war proves something definite one way or the other, the matter must be left. The big ship has been doomed so often, and so often adapted itself to changed conditions, that it may well do so again, despite the seemingly heavy odds against it.

PROTECTED CRUISERS OF THE DREADNOUGHT ERA.

The original conception of the Dreadnought era was "nothing between the most powerful armoured ships and torpedo craft," though so far as second class cruisers were concerned the last of these had been laid down in 1901.

The persistence with which Germany continued yearly to build small protected cruisers eventually, however, began to cause some perturbation; and in the 1908-09 Estimates five protected cruisers of the *Bristol* class were provided for. These were the *Bristol* (Clydebank), *Glasgow* (Fairfield), *Gloucester* (Beardmore), *Liverpool* (Vickers), *Newcastle* (Elswick). The designed displacement was 4,820 tons, length 453 feet over all, beam 47 feet, and mean draught $15\frac{1}{4}$ feet. Armament two 6-inch, ten 4-inch, and two submerged tubes. A speed of 25 knots was expected from 22,000 horse-power. On trials all exceeded 26 knots. All were fitted with Yarrow boilers, also turbines of the Parsons type, except in the *Bristol*, in which Curtiss type turbines were installed.

For 1909-10 four more similar ships were provided—the *Weymouth* class. Displacement rose to 5,250 tons, and a uniform armament of eight 6-inch was substituted for the mixed armament of the *Bristol* class. These four "Town" cruisers were the *Weymouth* (Elswick), *Yarmouth* (London and Glasgow Co.), *Dartmouth* (Vickers), and *Falmouth* (Beardmore). All were given Yarrow boilers and Parsons turbines except the *Weymouth*, which was supplied with Curtiss turbines.

The Estimates of 1910-11 contained three cruisers, the *Chatham*, *Dublin*, and *Southampton*, of the same type, but with a displacement increased by 200 tons.

Three more, the *Birmingham*, *Nottingham*, and *Lowestoft*, figured in the Estimates of 1911-12.

In 1907 the practice was instituted of building a Scout or two a year, those constructed to date being the *Boadicea*, *Bellona*, *Blanche*, *Blonde*, *Active*, *Amphion*, and *Fearless*, all of which are unarmoured, and so more or less compelled to fight modern destroyers on equal terms. Of these the *Amphion* was lost early in the war by a mine.

Of the original type were three Australian cruisers, *Sydney*, *Melbourne* and *Brisbane*, of which two were built in this country and the third built, or put together, in Australia. In all these ships the slight increase in displacement was due to the introduction of a thin armour belt amidships—a "reply" to a similar innovation in the German Navy.

The 1912-13 Estimates saw no more of the "Town" class cruisers being provided for, but, as already stated, they heralded the appearance of eight vessels of a new type, officially described as "lightly armoured cruisers."

They were at one and the same time an entirely new type, and also a reversion to the original *Bristol* with modifications born of experience.

In essence, these ships of the *Arethusa* class—*Arethusa*, *Aurora*, *Galatea*, *Inconstant*, *Royalist*, *Penelope*, *Phaeton* and *Undaunted*, compared with the prototype as follows:—

	Arethusa.	*Bristol.*
Displacement (tons)	3520	4800
Armament	2—6in.	2—6in.
	6—4in.	10—4in.
	4 above water t. tubes	2 submerged t. tubes
Side protection	2½"	*nil.*
H.P.	30,000	22,000
Speed (est) kts.	30	25

Fuel supply has never been given out officially, but it may be stated that, roughly, by making use of oil fuel in the *Arethusa*, a radius equal to that of the *Bristols* was secured with a considerable saving in weight.

Incidentally, this is one of the most interesting examples of how the progress of invention makes possible to-day the impossibility of yesterday. When the *Bristols* were designed they were the "best possible" of 1908. Four years later oil fuel had opened out an entirely novel vista.

In the 1913-14 Estimates another eight of similar cruisers were provided for, with, however, 250 tons odd added to the displacement and an extra 6-inch gun forward allowed for; though this, however, was altered afterwards, as this batch of cruisers, the *Calliope*, *Caroline*, *Carysfort*, *Champion*, *Cleopatra*, *Comus*, *Conquest*, *Cordelia*, do not carry any 6-inch guns forward like the *Arethusa*, but mount a couple, one abaft the other aft—a wise arrangement, as a heavy weight forward does not make for sea-worthiness.

The *Arethusas* and the "C" class, therefore, compare as follows:—

	Forward.	Amidships.	Aft.
Arethusas	One 6in.	Four 4in.	One 6in., two 4in.
"*C*" *class*	Two 4in.	Six 4in.	Two 6in.

which indicates a couple of 4-inch guns gained for the extra 250 tons.

In the 1914-15 Estimates four similar vessels were provided for, but no details whatever have been published concerning them.

DESTROYERS IN THE DREADNOUGHT ERA.

The Dreadnought era, while simplifying types of big ships, was the early institution of two distinct types of destroyers, plus an experimental vessel which was not duplicated. The original staple idea of Dreadnought era destroyers was to build very fast ocean-going destroyers for fleet work, and smaller craft, "coastals," for local duties. A considerable flourish of trumpets accompanied the announcement of this decision, which, however, was in no way really novel. It merely reproduced in destroyers the long exploded idea of sea-going and coast-defence ironclads.

Of these boats the first instalment amounted to a total of eighteen; the most important being the experimental boat *Swift*, which was given a displacement of 1,825 tons, and so might just as well have been designated a fast small cruiser. The horse-power provided was no less than 30,000, the speed 36 knots, though on trials she once reached nearly 39 knots. Armament four 4-inch, two 18-inch tubes. Cost about £280,500.

It is interesting to note that in 1885 a precisely similar idea found vent in a *Swift* (afterwards re-named t.b. 81) of 125 tons against the 40 to 65 tons that was then normal for torpedo boats. It was nine years before anything else of the same size was built.

The first standard destroyers of the era were the "Oceans" (often known as "Tribals"). These averaged 880 tons, 33 knot speed with oil fuel only. Between 1906 and 1910 altogether a dozen were built. The armament given to the five first was five 12-pounder, and two 18-inch tubes; in later boats two 4-inch, 25-pounder were substituted for the five 12-pounders.

The "coastal destroyers," which have since lost that name, and are now known as first-class torpedo-boats, were built in groups of twelve for three years; the first batch averaging 225 tons, and later boats about

260 tons. In all the armament is two 12-pounder and three 18-inch torpedo tubes; speed 26 knots. Parsons turbines in all, and oil fuel instead of coal.

In 1908-09 there came a revulsion of official feeling against both types, and an attempt to evolve a species of intermediate was made. It was held that the Oceans were exceedingly costly; also somewhat fragile. The new boats, the *Beagle* class, averaged 900 tons instead of the thousand tons that the latest Oceans were getting to. Armament was reduced to one 4-inch, 25-pounder, and three 12-pounders, with the usual two 18-inch torpedo tubes. Speed was cut down to 27 knots. Oil fuel was done away with, and coal reverted to.

The 1909-10 programme provided for 20 destroyers of the *Acorn* class. These are slightly smaller than the *Beagles*, armed with two 4-inch and two 12-pounders, but with oil again instead of coal only.

On account of considerable agitation in Parliament as to the small number of modern British destroyers, the construction of all this class was accelerated by a few months, and with a single exception they were completed in June, 1911.

Up till this time considerable latitude had been given to contractors for destroyers. In the 1910-11 programme the *Acheron* class, an Admiralty design, was given out for fourteen of the boats, which, except that they had two funnels instead of three, closely corresponded with the destroyers of the preceding year. In the other six boats the firms of Thornycroft, Yarrow, and Parsons were given some considerable freedom of design with two boats each, and an increased speed was obtained with all.

For 1911-12 boats a similar principle was followed, and there was also still further acceleration. These latest boats are somewhat faster than heretofore, and an interesting innovation in the case of one of them—the Thornycroft type—is the appearance of the Diesel engine for partial propulsion instead of steam. As a matter of fact, this idea did not eventually materialise, owing to various circumstances of the side issue nature. More or less contemporaneously with this the Yarrow firm in the *Archer* and *Attack*, their special destroyers, evolved a system of super-heated steam, which led to a very considerable increase in speed, as compared with older methods. A conflict between steam and "gas engines" for destroyers was, therefore, in 1912, a probable feature of the early future, a conflict still in the "to-morrow" stage; but it may be unwise to place too much reliance on the fact that a similar conflict with motor cars ended in the practical extinction of steam, for all that the probabilities point in that direction. The superior convenience of the Diesel engine whether for destroyers or larger ships is obvious, but there are undoubtedly still certain practical difficulties which cannot be ignored.

In 1912 the destroyer may be said to have reached its apotheosis. Later boats are considerably larger, more powerfully armed, and occasionally a trifle faster. but, taken all in all, they do not indicate any definite advance on the "general idea" of a destroyer.

Novelty, such as it exists, is confined to the introduction of flotilla leaders. The idea is not new, since the Germans hit on it for torpedo boats long before destroyers as we understand them were evolved. There is also the still older idea of our original *Swift*.

The integral notion is in each case the same. The idea is to provide the commander of the flotilla with a boat swifter and more powerful than those of his normal command, and thus to enable him to reinforce as requisite any particular portion of his squadron. Thus viewed, the idea is, of course, as old as naval warfare itself, or, for that matter, any warfare whatever ; and it is strange that the principle of the superior power of the chief should ever have been allowed to lapse.

It is, however, curious to note that at the outbreak of the present war the British was the only Navy in which the idea was in actual practice. Not till the war is over shall we learn whether the seeming advantage is or is not of real value. All the indications, however, are that it should be an immense asset if properly handled.

GUNS OF THE WATTS ERA.

The principal guns of the Watts era are as follows :—

Calibre in.	Length in cals.	Weight tons.	Weight of projectile lbs.	Maximum penetration A.P. capped against K.C.	
				at 5000 yds.	3000 yds.
				in.	in.
13.5	45	80	1250	22	26
12	50	58	850	19	24
12	45	50	850	$17\frac{1}{2}$	22
9.2	50	30	380	10	13
9.2	45	27	380	$8\frac{3}{4}$	$11\frac{1}{4}$

It may be noted that the 12-inch, 45 cal. (as mounted in the original *Dreadnought*) is quite capable of penetrating anything in existence at most ranges, and the 12-inch, 50 cal. anything likely to exist. The main advantage of the 13.5 is the superior weight of the projectile and the better capacity of its shell.

Modern progress in gunnery is remarkably demonstrated by a comparison between the 13.5 of the Barnaby era and the same calibre of the Watts era.

Calibre in.	Length in cals.	Weight tons.	Projectile lbs.	Maximum penetration A.P. capped against K.C. at		Corresponding value in K.C. of belt of ship carrying
				5000 yds.	3000 yds.	
13.5	30	80	1250	9	12	9
13.5	45	67	1250	22	26	12

From which it will be seen that armour has in no way kept pace with the gun, except in so far as that in the conditions which obtained with the old 13.5 a range of 3,000 yards was considered an outside limit, 12,000 yards is now held in the same or even less estimation.

Along such lines progress has been practically nullified during the last twenty years. But the limit of vision has now been reached, and increased gun-power cannot, practically speaking, any longer be met by range. Whence the argument of many that, failing the production of some armour altogether superior to anything now existing, the armoured ship is closely approaching the status of the armoured soldier of the Middle Ages. A precisely similar remark, however, was first made in 1887,* and proved an incorrect prophecy. To-day, therefore, those best able to judge are extremely careful about prophecying.

Meanwhile, the outbreak of war synchronised with the fact that both the British and German Navies had under construction ships carrying 15-inch guns; thus

* Something of the same kind was also observed about 1870 or earlier, when a Whitworth gun punched through a 6-inch iron plate!

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indicating a trend of opinion towards ships capable of delivering heavier and heavier projectiles.

TORPEDO PROGRESS.

The principal feature of the last few years has been the steadily increasing efficiency of torpedoes, mainly by the adoption of improved engines. For many years 2,000 yards had been the maximum torpedo range. About 1904 an 18-inch Whitehead with 4,000 yards range and a maximum speed of 33 knots came into service. This was presently improved upon by torpedoes of 7,000 yards range. The exact range of the latest type Hardcastle torpedo—so called after its inventor, Engineer Commander Hardcastle—is a matter of uncertainty, but it is supposed to be capable of about 7,000 yards at 45 knots, and up to 11,000 at 30 knots. As a torpedo would take about 5½ minutes to travel this distance, it is obviously unlikely to be able to anticipate the position of a single enemy sufficiently to ensure hitting her, except by pure chance. On the other hand, if a fleet be fired at, hits with a torpedo are almost as likely as hits from a gun, and it seems impossible that the old idea of ships fighting in line can possibly survive, and Admiral Bacon's theory that for the squadron of the past there will have to be substituted the isolated monster ship of the future seems the only reasonable one, despite all the protests against "mastodons."

With the improvement of torpedoes, especial attention has been devoted to under-water protection against them. One form of this, the solid bulkheads of the original *Dreadnought*, was, after a time, partially abandoned owing to its extreme inconvenience. Another form of protection adopted in all Dreadnoughts is a certain amount of internal armour, an idea first evolved in France for the battleship *Henri IV*, which was laid down in July, 1897. Experiments with a view to testing the efficiency of this device were not very promising. An improvement on the system was effected by M. Lagane, of La Seyne, in the Russian *Tsarevitch* in 1899. This ship was actually torpedoed in the Russo-Japanese War, but unfortunately she was not hit on the specially-protected portion, so no experience was gained of the war utility of the system. While at the outbreak of war it was believed by some that the modern system is proof against half a dozen torpedoes, others were extremely sceptical as to whether any real immunity is afforded. The most that could ever be prophesied was that the next naval war would see the torpedo accomplish either a great deal more or a great deal less than is generally assumed. A paradoxical position; but so things are! No one can predict with any more certainty, even now that war is on us. We do not know what may happen. Some of us adhere to the idea that the torpedo is going to be omnipotent: that the gun is going to be relegated to the second place. The future is likely enough to discount the destroyer idea. But, from the submarine the torpedo is likely to do many unexpected things. If the Germans realise the torpedo, startling things are toward.*

The period just preceding the war saw a curious state of affairs in connection with net defence against torpedoes. Practically ever since nets were invented the use of them had been confined to the British, Russian and Japanese Navies—most other navies making no use of net defence. Curiously enough the adoption of nets by

* Since these words were written the *Lusitania* has been torpedoed I see no reason whatever to alter the original thesis.

Germany and Austria coincided with their abandonment in the British Navy—the British theory being that net cutters had become so efficient that any kind of net would immediately be cut through. Incidentally it may be observed that with nets down a ship can only proceed at a very slow speed.

NAVAL ESTIMATES OF THE WATTS ERA.

Financial Year.	Amount.	Personnel.	Ships provided.			
			Battle-ships.	Battle-cruisers.	Armoured cruisers.	Prot. cruisers.
1902-03	31,003,977	122,500	2	—	2	—
1903-04	35,709,477	127,100	3	—	4	—
1904-05	36,859,681	131,100	2	—	3	—
1905-06	33,389,500	129,000	1	3	—	—
1906-07	31,472,087	129,000	3	—	—	—
1907-08	31,419,500	128,000	3	—	—	—
1908-09	32,319,500	128,000	1	1	—	5
1909-10	35,142,700	138,000	6	2	—	3
1910-11	40,603,700	131,000	4	1	—	3
1911-12	44,392,500	134,000	4	1	—	3
1912-13	44,085,400	136,000	3	1	—	—

Later in 1912 the sum of £1,000,000 was handed to the Navy out of the Budget surplus. This sum, the "supplementary estimate," was allotted in order to set off a corresponding German increase.

The decrease of 1905-1908 is probably directly responsible for the increase 1910-1912; owing to the fact that the British decrease was met by a corresponding rise in German expenditure. It was the fashion before the war to deplore the sums spent on naval armaments, while little or nothing was said about the military estimates.

For 1912-13 the Naval Estimates were £45,075,400.

For 1912-14 they increased to £48,809,300, and for 1914-15 they stood at £51,550,000.

On the face of things, this ever-increasing naval outlay looked likely to lead to ultimate financial ruin. This, however, is really a somewhat superficial view, and mostly nothing but a modern equivalent to that "Insular Spirit" which has been referred to in previous pages.

Compared to the national interests at stake, the increase regarded as an insurance is more apparent than real. It is, if anything, a smaller percentage on national existence; also over a period of a hundred years it is far less than the corresponding increase in the Civil Service Vote, which lacks any claims to be considered an "insurance." The entire amount spent in shipbuilding is expended in the country, and about 70 per cent. of it goes in direct payment to "Labour": which is probably a larger percentage than would be achieved were the same sum spent in any other way whatever.

The "ruinous competition in naval armaments" so prated on by certain publicists was really little better than an idle phrase so far as the British nation is concerned; and there was never any real reason to regard future increases with apprehension.

Now that the nation is at war this fact is being recognised. We must continue to recognise it. In trenches over the water we may attack. But on the British Navy depends our defence of home interests.

V.

SUBMARINES.

THE submarine as anything of the nature of a practical arm made its first appearance as a "submarine torpedo boat," useful merely for harbour defence. As such it was eagerly embraced by the French Navy, and had a considerable vogue therein, besides being a commonplace in the United States long before the British Admiralty accepted it as serious in a way.

As a matter of fact, till the invention of the periscope enabled it to see where it was going when submerged, the submarine was little if anything but a paper menace. The periscope altered all this.

The first submarines for the British Navy figured in the 1901-2 Estimates. Five copies of the American *Holland* were laid down at Barrow, the first being launched in October, 1901. These boats were of 120 tons submerged displacement, and used merely as instructional or experimental craft almost as soon as completed.

They were followed immediately by the "A" class, totalling thirteen boats in all. Displacement submerged, 207 tons. Those numbered from five to thirteen were given sixteen cylinder surface motors of 550 horse-power in place of the 450 horse-power twelve cylinder ones of the earlier boats. In 1904 A1 was lost with all

SUBMARINES LEAVING PORTSMOUTH HARBOUR.

hands under tragic circumstances off Spithead, being run down by a merchant steamer. This disaster led to the installation of double periscopes in later types. A3 was lost off Spithead in 1912, being run down by the *Hazard*, very near where A1 was lost.

The B class which followed numbered eleven boats, of which B1 was originally known as A14. The remaining B class belong to the 1904-05 Estimates. The submerged displacement in these rises to 313 tons, and the surface speed to thirteen knots, instead of eleven and a half, though, owing to improved lines, the horse-power was little increased.

New boats, completed in 1906 and later, though generally identical with the B class, were known as the C class, and totalled thirty-eight altogether. One, C11, was lost at sea from a collision.

In 1907 the earliest boat of a new type (D Class) was put in hand. Displacing 600 tons submerged, she practically doubled her predecessors. Her surface speed rose to sixteen knots with 1,200 horse-power. Three instead of two torpedo tubes were fitted, also wireless telegraphy was experimentally adopted in her. She herself was never any great success, but the rest of the type were far more successful.

By the end of 1911 eight boats of the D class had been launched. It was originally intended to build a total of nineteen of this class, but meanwhile an improved boat of the E type was evolved. The E class are 177ft. long, with a submerged displacement of 800 tons or thereabouts, and four 21-inch tubes. They are fitted with wireless. Their special feature, however, is the fitting of guns, as a regular and integral part of the design.

The first submarine to mount a gun was D4, in which a special 12-pounder was experimentally mounted, so that it could be housed when the boat was submerged; for later boats two guns were decided on.

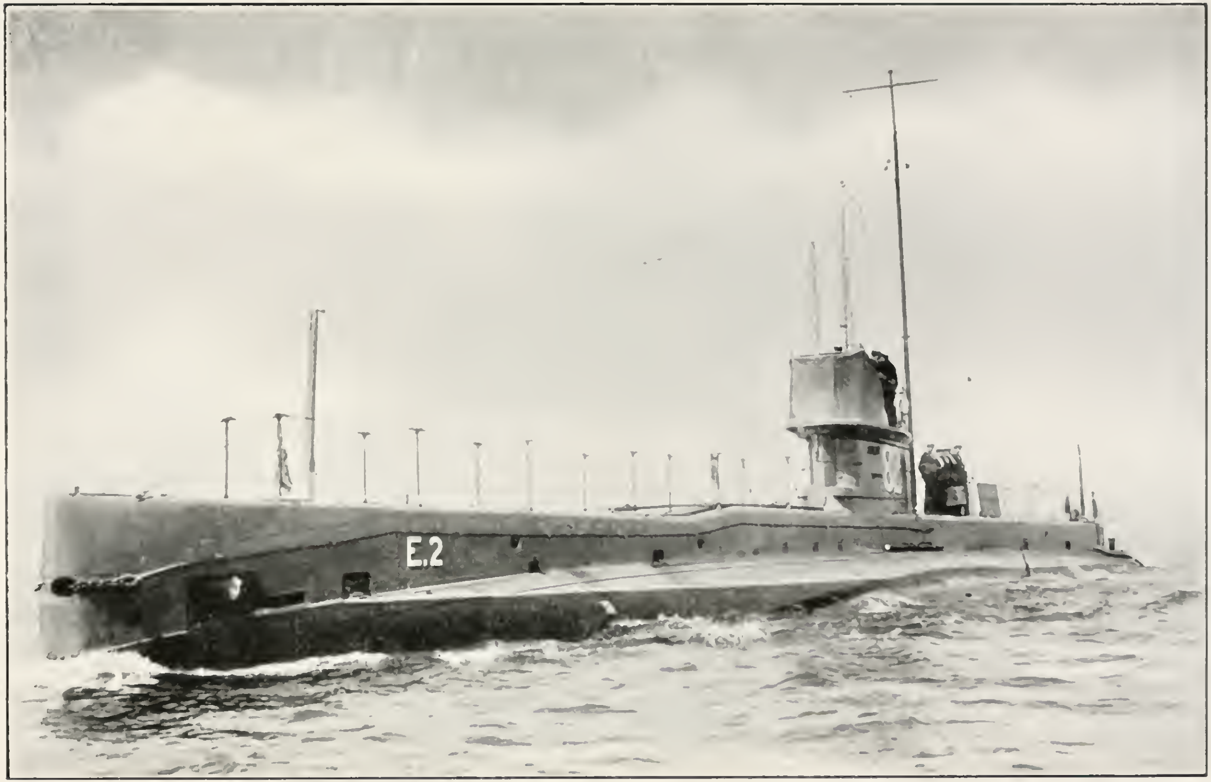
The E class were followed by an F class—and a variety of other boats, most of which have been completed since the war began and concerning which it is obviously undesirable to say anything whatever.

Guns for submarines were expected to appear sooner than they actually did. At an early stage it was foreseen that, once radii developed, submarines were likely enough to find themselves in contact with hostile submarines and to need something to attack them with. The original idea of the submarine as "the weapon of the weaker Power" soon went the same way as did a similar idea about torpedo boats at their first inception.

In torpedo-boats it was at once self-evident that, whatever the value of the torpedo boat, the stronger Power was able to build far more than the weaker, and to annihilate accordingly.

For a time the submarine seemed to defy this law. It was fatuously hoped that "submarines cannot injure hostile submarines"; and that the "torpedo boat is the answer to the torpedo boat" would not have as sequel "the submarine is the answer to the submarine."

It may well be in the womb of the future that submarines to-morrow, or perhaps to-day, may be what the ironclad was yesterday or the day before. The submarine battleship may appear and render obsolete the "Dreadnought" of to-day! But nothing can alter the cardinal fact that, given equal efficiency, the Power with most such craft must win, and that, given an inferior efficiency, defeat may be looked for as the natural



Photo] [*Stephen Cribb, Southsea.*

SUBMARINE E 2.

corollary on lines entirely unconnected with whether the "capital ship" is of a type that floats only or one that can be submerged at will.

Tactics may alter, the means may alter, and the most obvious instruments of naval strategy may do the same. But nothing whatever can affect the bedrock truth that, given equal efficiency, "numbers only can annihilate." Given the "equal efficiency" nothing else really matters!

If the creators of weapons keep themselves to date, if those who supply them see to it that the supply is sufficient, if those who work the weapons are efficient, the part of those in chief control resolves itself into little save achieving victory with the minimum of loss. The day may yet arrive when someone discovers that a good deal of what has been written about the genius of various famous admirals of the past is verbiage rather than fact, that they were a part of one great whole, rather than the sole controlling organisation—at any rate, once battle was engaged.

In the future, if the submarine "Dreadnought" becomes an actuality, this is probably likely to be so to a greater extent than anything which obtained in the past. So far as we can to-day conceive of such future fights, much of the battle, at any rate, will entail more or less blind work under the surface, individual enemies engaging one another, the leader compelled to rely more and more upon the efficiency of his individual units and less and less upon his own tactical combinations.

Of course things may turn out otherwise. Inventions yet undreamed of may come to the fore, and the nether waters present no greater obstacle to regular operations than the surface does to-day. Plunging may offer no salvation to a beaten enemy. We can only make idle speculations now.

Yet, however things may shape, success or failure, victory or defeat must assuredly depend in a great measure on the makers of the weapons and the efficiency of those who work them—the tools, on the reliability of which every admiral must trust for victory.

When this war started there were roughly thirty German submarines to something like seventy British. At the moment of writing (June, 1915) at least twenty of those German submarines have gone below. How and why cannot be published: but they have gone under in one way or another. Means of defeating submarines are being developed.

Where big ships are concerned the principle means in use are high speed and a zig-zag course, the combination making it difficult for the relatively slow submarine to arrive at the correct striking point.

In this connection it has to be remembered that the vision of a submarine is limited; and so that though the range of modern torpedoes is something like five miles, the actual effective range of a submarine's torpedoes is nearer a mile or less.

So much is this the case that German submarines are fitted with a torpedo which has a range of only a thousand yards or thereabouts, the reduced range being compensated for by a greatly increased charge. This charge, 420 lbs. of very high explosive instead of the usual charge of 300 lbs. or less, accounts for the devastating effects of German torpedoes fired from submarines.

It is merely a phase in submarine warfare. At present a submarine dare not fire too near its victim lest it be involved in the common destruction. That, however, is likely enough to be guarded against in future construction, and the prospects of the early future is one of more importance for submarines rather than less. They are bound to become larger and larger, their radius increasing with the size. Coincidently with this we may expect to see the birth of small submarines designed to attack big ones: some new variant of the swordfish and the whale.

VI.

NAVAL AVIATION.

THE aeroplane idea is so old that we find it in Greek mythology, and it is consequently of unknown antiquity. Hundreds of years before Christ there were hoary old legends of Dædalus and Icarus, who made wings for themselves and flew. Icarus flew too high, the sun melted his wings, with the result that there happened to him what happens about once a week to aviators to-day, he fell and died. Contemporary with these legends, are legends of floating rocks which spurted out fire—stories which sounded inestimably silly till steamships came along. We may imagine prophets able to look ahead* and to invest their day with visions of the future. Equally we can discard prophets and imagine a civilisation long since dead which knew all about flying and steamers, and survives in legends only.

The latter alternative is really the more reasonable of the two. While imagination can do a very great deal and exaggerate to any extent, it must have a base to work on. It is easier to believe in some long gone and extinct civilisation which destroyed itself in the air, than to believe that pure imagination accounts for the flying

* Dean Swift in "Gulliver's Travels" described almost exactly the moons of Mars long before their existence was ever suspected.

Photo] [illegible]

BRITISH NAVY SEAPLANE.

stories of long ago. Africa is full of traces of vast cities older than any history, telling of past civilisations of which nothing is or ever will be known. Also there is practically no known age in which anything but the motive power stood between aeroplane theories and their realisation.

In support of the theory that men flew before to-day there is the following :—Somewhere about the year 1100, that is to say, back in the reign of King Stephen, a French historian relates the appearance of "as it were, a ship, in the air over London." It anchored, and the citizens of London got hold of the anchor. The air-ship sent a man down to free it, and the citizens of London caught him and drowned him in the river. The rest of the aviators then cut the rope and sailed away.

This incident is mentioned so baldly and casually and so much mixed up with ordinary petty chat of the era (chat which proves to have been quite true), that it takes far more faith to accept it as "pure lies" than to accept it as fact more or less.

These legends cannot be disregarded lightly. They one and all give priority to the aeroplane—the "heavier than air" vehicle. Once in a way the "lighter than air" idea got a casual look in ; but it was not till the end of the eighteenth century that it got into the regions of practical politics with the French Montgolfiers. But there were people who invented elementary aeroplanes long before Montgolfier.

From the end of the eighteenth century until to-day the Montgolfier idea of "lighter than air" has got little further. The shape has altered ; instead of hot air, hydrogen gas is now employed ; and by means of motors the balloon no longer drifts before the wind. But progress is terribly slow. That it is so, is a very important thing to recognise, as slow development is by no means a reason for ignoring an invention. Sometimes it is quite the opposite.

It will probably be a good many years before it is definitely settled whether the "heavier than air" or "lighter than air" principle is the better for Naval purposes, though there are not wanting enthusiasts who decry the "lighter than air" machines altogether.

This is probably a grave mistake, brought about by the fact that practical balloons existed long before practical aeroplanes, and dirigibles made flights before ever aeroplanes rose off the earth. Yet the dirigible is in a far more elementary stage than the aeroplane is. Not only is the aeroplane a much older idea in the theoretical direction, but, being very much smaller, it on that account has very possibly developed more quickly.

The world has been building ships for thousands of years, yet it has only recently developed *Tigers* and *Olympics*, and both are still developing and likely to do so for some time to come. Row-boats, however, arrived at perfection a good thousand years ago. That is to say, there has been no alteration or improvement in them at all commensurate with the alterations that have taken place in big ships during the same period.

Something of the same sort is quite possible with aeroplanes. It is already comparatively easy to forecast their eventual form without much danger of being proved a false prophet later on. We may safely say that

Photo]

HOISTING A NAVAL SEAPLANE ON BOARD THE *HIBERNIA*.

they will become capable of much higher speeds than at present; also (which is perhaps more important) *slower* speeds; and that all existing troubles with stability will eventually be overcome. But experiments made with birds indicate that the run which an aeroplane has to take before it can rise occurs in much the same proportion with birds; and so there are few, if any, practical men who now expect to see future aeroplanes capable of rising vertically from the ground, or hovering in the air except under such conditions as any bird can hover without inconvenience.

The possibilities of the dirigible, on the other hand, no man can foresee. The gasbag that can be brought to the ground by a single bullet hole in it, is a very different thing from the possibility of airships of the future, which may be a mile or two long, divided into innumerable compartments, filled with non-explosive gas such as is sure to be discovered sooner or later. Two miles seems an extraordinary length to-day, but a ship ten miles long would only be something like the ratio of the early dirigible to the future ones compared to the ratio Dreadnoughts bear to the first ships built by men.

On the water, bulk is limited by the depth and size of harbours, but in the vast regions of the air there are practically no limitations whatever, and there is virtually nothing to limit size, save the building of land docks on open plains into which airships could descend for purposes of repair and so forth. Consequently those who hastily assume from a few accidents that the "lighter than air" craft has no future are probably making a mistake; at any rate, so far as naval work is concerned. Certain definite uses are apparent even now to those who think and ignore commercial rivalries.

It has been wisely laid down that aeroplanes for naval purposes must be capable of rising from and descending on the water. The Curtiss was the first successful hydro-aeroplane, but since then floats have been fitted to various other types with equal success. It is doubtful whether naval aeroplanes will ever be carried on shipboard like boats, although this is by no means impossible. It will, however, be more convenient for a variety of reasons to use them like submarines with their own special depot ships.

The main naval use of aeroplanes at the outbreak of war was for scouting purposes. How near they would be able to approach a hostile fleet was a question not likely to be solved until the day of battle. The question of their being hit is secondary to the question of their being upset, owing to tremendous concussions of heavy gun fire. The idea of aeroplanes dropping bombs down the funnels of warships can be dismissed as the entirely fanciful dreams of people who know nothing whatever about aeroplanes or the mathematical problems involved. Judging by recent events, dropping bombs anywhere upon a moving ship is nearly or entirely impossible, except at ranges where the aviator would at once be brought down by rifle fire.

A far more likely and useful service would be the destruction of enemy aeroplanes. For this purpose a special gun, firing a species of chain shot, has already been suggested, and the naval aeroplane of the future was always certain to carry a gun of some kind. The off-chance of doing a certain amount of damage to a hostile ship by dropping a bomb upon it, is nothing compared to the importance of destroying the enemy's aeroplanes. This last seems likely to be all-important as time goes on.

The duties of naval airships will be of a different nature. Already a point kept in view in their design is ability to "keep the air" for a considerable period, and with what are in these days "large airships" of the Zeppelin type (to which the ill-fated Naval Airship No. 1 *Mayfly* belonged) there seems no reason why an airship should not be kept in the air for three or four days already.

The fuel problem is not very difficult, because a great deal can already be done without the use of the engines, or with only partial use of them. It is also more than probable that with a view to further economy some kind of sails, combined with sea-anchors, will be evolved, whereby the ship might become able to sail in the air nearly as well as the old three-deckers, or, at any rate, as well as the masted ironclads, sailed in the water. The difficulty of "keeping the air" is the inevitable leakage of gas, but as leakage nowadays is infinitesimally less than it once was, the assumption is that as the years go on it will eventually be reduced to almost a minus quantity. Gales will be met by "bulk" and efficient anchors, on the principle that the gale which swamps a fishing-boat or blows over a haystack has no effect on a Dreadnought or a cathedral.

Ability to keep the air will enable all Fleets to be accompanied by airships, which would detect mines and perhaps submarines, and with their ability to adapt their speeds at will, the presumption is that they would be able to destroy submarines by bombs.

A further and very important duty would be the detection of torpedo attacks at night. Experiments carried out in Austria some few years ago with a captive balloon proved conclusively that except in cases of thick fog any vessels in motion are easily detected at a distance of ten or twelve miles. It is not merely the tell-tale flames in the funnels which betray attacking vessels; their wakes are always clearly visible, and as a general rule the vessels themselves, no matter how dark the night.

Bomb-dropping from an airship must be a more serious matter than from aeroplanes, as so much more in the way of explosives could be carried. The chance of being hit, however, would probably be so much greater that it was (when war broke out) unlikely that any airships would be risked for such purposes. Nor is it very probable that naval airships will for some time to come attack each other, if they can possibly avoid it, the reason being that for a good many years they will be comparatively few in number, and the attack would have, in most cases, to be delivered in the presence of a fleet, which would make the attack, to say the least of it, very hazardous.

Eventually, of course, aerial Dreadnoughts fighting each other are probable enough; but "the Trafalgar of the air" is unlikely to be witnessed within the lifetime of most or any of us now living. Nor is it likely that aerial Dreadnoughts will replace Dreadnoughts of the water, although as years go on they may cause profound modifications in design in order to allow of mounting guns for vertical fire.

We are in the presence of the introduction of a "new arm." But between what a "new arm" can actually accomplish, and what enthusiastic inventors say it will do, there is always an enormous gap. Inventors, when they come to prophesying, are usually one of two things —asses, or prodigious asses! France—once the second Naval Power in Europe—became of little or no account because it took the submarine at the enthusiastic inventor's face value, and neglected the present and immediate future.

The present stage of aerial progress in the British Navy is briefly to be summarised as follows :—

1. A big Zeppelin type naval airship was built in 1909-1911. It proved a total failure.

2. In 1911 four naval officers were appointed to learn aeroplane work. Subsequently a few others were appointed. Others, again, qualified privately. In 1912, the Royal Flying Corps was established—both naval and military aviators becoming "wings" of the same body—an excellent principle, but one necessarily experimental so far as practical work was concerned.

3. In practice it proved a failure; so the Naval Air Service was formed into a branch by itself. Four small army airships were handed over to it—craft too small to be of any value except for instructional purposes.

At the outbreak of war there were two effective dirigibles—one of French type of Astra-Torres design, the other a Parseval purchased in Germany. Neither of these ships is in any way comparable to the German Zeppelins in dimensions or endurance. A number of other dirigibles of varying sizes were on order, but it is inadvisable to publish any particulars on this subject. The designs for these were foreign, but the construction was British.

In the matter of aeroplanes a number of special naval stations were established and supplied with seaplanes and landplanes of various types, while strenuous efforts were made towards the training of a large number of efficient pilots. The building of an aeroplane is a matter of only a few weeks, whereas the training of a really efficient pilot is a matter of a year or thereabouts.

VII

AUXILIARY NAVIES.

NO account of the British battle fleet would be complete without reference to the various auxiliary navies. Though none of them possesses any very serious fighting value, yet all possess potentialities for the future which can with difficulty be computed.

The auxiliary navies may be divided into two main sections—(1) those which are direct branches of the British Navy, and (2) those which belong to the semi-independent colonies.

Of the former, the principal is the Royal Indian Marine, which consists of a number of armed troopships. Of these the chief are the *Northbrook*, launched at Clydebank in 1907, 5,820 tons, 16 knot speed, and an armament of six 4-inch and six 3-pounders. The *Dufferin*, which was launched in 1904, is of 7,457 tons, has a speed of 19 knots, and an armament of eight 4-inch and eight 3-pounders. The *Hardinge*, launched 1900, is of 6,520 tons, 18 knots speed, and carries six 4.7-inch guns as well as six 3-pounders and 4 Maxims.

There are three older troopships, the *Minto* (1893), the *Elphinstone* (1887), and the *Dalhousie* (1886). These are supplemented by ten small steamers and nine small mining vessels.

The germ of this fleet was created in the early seventies when the breastwork monitors *Abyssinia* and

Magdala were sent out for the defence of Indian harbours. These were small predecessors of the *Devastation*, very similar to the home coast-defence monitors of the *Cyclops* class, and carried four 18-ton muzzle-loading guns.

About the year 1888 some new torpedo boats (Nos. 100-106) were lent for the Indian Marine service. These, with their names and numbers, were as follows:—*Baluch* (100), *Ghurka* (101), *Kahren* (102), *Pathan* (103), *Maharatta* (104), *Sikh* (105), and *Rajput* (106). The two earliest numbers were built by Thornycroft, and were of 92 tons; the others were built by White, of Cowes, and were of 95 tons displacement.

In the years 1890-91 two torpedo gunboats, *Plassy* and *Assaye*, of the *Sharpshooter* class, were launched at Elswick for the Indian Marine, in which they remained until withdrawn in the early years of the present century.

On a similar footing to the Royal Indian Marine are the flotillas, mostly consisting of river gunboats, maintained in North and South Nigeria and in Central Africa, and the gunboats on the Nile under the Egyptian Government.

The Colonial Navies are on a different standing. First place in their formation belongs to Australia. The monitor *Cerberus*, practically a sister of the *Abyssinia* and *Magdala* already mentioned, was launched at Jarrow in 1868 for Victoria. This vessel (which still exists as a drill ship) is of 3,480 tons, armed with four 18-ton muzzle-loaders, and protected with an 8-inch belt.

In 1884 Australia's local defence was re-inforced with four gunboats as follows:—The *Protector*, of 920 tons, carrying one 8-inch and five 6-inch guns, for South Australia. She, as well as the others, was built at Elswick. For Western Australia a similar vessel of

530 tons, named the *Victoria*, was built, armed with one 18-ton muzzle-loader. The *Gayundah* and *Paluma*, also of the same type, carrying one old 8-inch and one 6-inch, were built for Queensland. Their displacement is 360 tons each.

From that time onward the Australian Navy occasionally sent a few officers and men for training in the British Navy.

Towards the end of the eighties interest began to be taken in Australian naval defence, and five cruisers and two torpedo gunboats were ordered for local Australian service while borne on the Royal Navy List. Of these vessels the five cruisers were the *Katoomba* (ex *Pandora*), *Mildura* (ex *Pelorus*), *Ringarooma* (ex *Psyche*), *Tauranga* (ex *Phœnix*), and the *Wallaroo* (ex *Persian*), all 2,575 vessels of the old *Pallas* class, of which at the time of writing the *Philomel* still exists. These ships had a designed speed of 16.5 knots, a protective deck, and an armament of eight 4.7-inch and some smaller guns.

The torpedo gunboat *Boomerang* (ex *Whiting*) and *Karrakatta* (ex *Wizard*) belonged to the *Sharpshooter* class, and were lent under the same conditions as the cruisers.

In the course of time all of them wore out and were eventually recalled.

Coincident with this the Australians commenced to have a revived interest in Imperial defence, and in the year 1905-6 Australia and New Zealand contributed £240,000 to Imperial naval defence, and a project was put forward for the building of eight destroyers and four torpedo gunboats for Colonial Defence purposes.

A few years later this project took a more definite shape, and about the year 1910 the battle-cruiser *Australia*, a sister of the *Indefatigable*, was ordered. As part of the same programme, three protected cruisers of the *Dartmouth* type, the *Melbourne*, *Sydney*, and *Brisbane*, were also ordered. Previously to this, three destroyers of the *Paramatta* type had been commenced, and in 1911 three more were ordered, thus forming a nucleus of a serious Australian Navy.*

New Zealand's interest in the Imperial Navy may be said to have commenced about the year 1900. It eventuated in paying for the battleship *New Zealand*† of the *King Edward* class, which was laid down in September, 1903. An old gunboat of the *Magpie* class was purchased, re-christened the *Amokoura*, and used for training purposes, while to replace some old torpedo boats, which had been sent to New Zealand about the same time as similar boats went to Australia, three destroyers of the *Paramatta* type were ordered. Finally, an offer from the New Zealand Premier to supplement the Dreadnought efficiency of the British Navy culminated in the battle-cruiser *New Zealand*, which was offered to be provided about the same time or a little before Australia offered a similar vessel.‡

The Dominion of Canada has always maintained a certain number of small vessels for Customs duties or fishery protection, also for service on the Great Lakes. In 1909 the question of a Canadian Navy became insistent, and two old British cruisers—the *Niobe* of the *Diadem* class and the *Rainbow* of the *Apollo* class—were purchased as training ships for the Canadian Navy. A project was also brought forward for the creation

* Of these, the third in either case was built or put together in Australia.

† Now re-named *Zelandia*.

‡ In May, 1912, the *New Zealand* was definitely handed over to the British Navy. The *Australia* still remains a Commonwealth ship.

BATTLE CRUISER 'NEW ZEALAND' ON THE STOCKS—1912.

of Canadian dockyards and building therein four second-class cruisers of the *Dartmouth* class and six destroyers, though up to the time of writing none of these ships have materialised, and the Canadian Navy is still very much a project in the air.

Newfoundland has a naval reserve, trained over many years in the drill-ship, which is ex H.M.S. *Calypso.*

The whole subject of Colonial Navies is somewhat involved, owing to the question as to how far they should be under the orders of and part of the British Navy, liable to be used when and where required for Imperial needs, and how far they should be regarded as merely for local defence. It has been argued from one point of view that Colonial Navies acting on their own responsibility might create undesirable Imperial complications—as for instance, Australia with Japan, or Canada with the United States. On the other hand it is argued that it would not be possible to arouse Colonial enthusiasm for a Colonial fleet which was not always on the spot, despite any strategical grounds that might exist for its being elsewhere. New Zealand, in May, 1912, negatived this by presenting her battle-cruiser to the Imperial Navy for use where most needed, but generally speaking Colonials think first of local defence.

These two divergent points of view, which are certainly extremely delicate, may be said to be still *subjudice*, but in the year 1911 the following agreement, which is of the nature of a very judicious compromise, was drawn up :—

1. The naval services and forces of the Dominions of Canada and Australia will be exclusively under the control of their respective Governments.

2. The training and discipline of the naval forces of

the Dominions will be generally uniform with the training and discipline of the fleet of the United Kingdom, and by arrangement, officers and men of the said forces will be interchangeable with those under the control of the British Admiralty.

3. The ships of each Dominion naval force will hoist at the stern the white ensign as the symbol of the authority of the Crown, and at the jack-staff the distinctive flag of the Dominion.

4. The Canadian and Australian Governments will have their own naval stations as agreed upon and from time to time. The limits of the stations are described in Schedule A (Canada) and Schedule B (Australia).

5. In the event of the Canadian or Australian Government desiring to send ships to a part of the British Empire outside of their own respective stations, they will notify the British Admiralty.

6. In the event of the Canadian or Australian Government desiring to send ships to a foreign port, they will obtain the concurrence of the Imperial Government, in order that the necessary arrangements with the Foreign Office may be made, as in the case of ships of the British Fleet, in such time and manner as is usual between the British Admiralty and the Foreign Office.

7. While ships of the Dominions are at a foreign port a report of their proceedings will be forwarded by the officer in command to the Commander-in-Chief on the station or to the British Admiralty. The officer in command of a Dominion ship so long as he remains in the foreign port will obey any instructions he may receive from the Government of the United Kingdom as to the conduct of any international matters that may arise, the Dominion Government being informed.

8. The commanding officer of a Dominion ship having to put into a foreign port without previous arrangement on account of stress of weather, damage, or any unforeseen emergency, will report his arrival and reason for calling to the Commander-in-Chief of the station or to the Admiralty, and will obey, so long as he remains in the foreign port, any instructions he may receive from the Government of the United Kingdom as to his relations with the authorities, the Dominion Government being informed.

9. When a ship of the British Admiralty meets a ship of the Dominions, the senior officer will have the right to command in matters of ceremony or international intercourse, or where united action is agreed upon, but will have no power to direct the movements of ships of the other service unless the ships are ordered to co-operate by mutual arrangement.

10. In foreign ports the senior officer will take command, but not so as to interfere with the orders that the junior may have received from his Government.

11. When a court-martial has to be ordered by a Dominion and a sufficient number of officers are not available in the Dominion service at the time, the British Admiralty, if requested, will make the necessary arrangements to enable a court to be formed. Provision will be made by order of his Majesty in Council and by the Dominion Governments respectively to define the conditions under which officers of the different services are to sit on joint courts-martial.

12. The British Admiralty undertakes to lend to the Dominions during the period of development of their services, under conditions to be agreed upon, such flag officers and other officers and men as may be needed.

In their selection preference will be given to officers and men coming from, or connected with, the Dominions, but they should all be volunteers for the service.

13. The service of officers of the British Fleet in the Dominion naval forces or of officers of those forces in the British Fleet will count in all respects for promotion, pay, retirement, etc., as service in their respective forces.

14. In order to determine all questions of seniority that may arise the names of all officers will be shown in the Navy List, and their seniority determined by the date of their commissions, whichever is the earlier, in the British, Canadian, or Australian services.

15. It is desirable in the interests of efficiency and co-operation that arrangements should be made from time to time between the British Admiralty and the Dominion for the ships of the Dominions to take part in fleet exercises or for any other joint training considered necessary under the Senior Naval Officer. While so employed the ships will be under the command of that officer, who would not, however, interfere in the internal economy of ships of another service further than is absolutely necessary.

16. In time of war, when the naval service of a Dominion or any part thereof has been put at the disposal of the Imperial Government by the Dominion authorities, the ships will form an integral part of the British Fleet, and will remain under the control of the British Admiralty during the continuance of the war.

17. The Dominions having applied to their naval forces the King's Regulations and Admiralty Instructions and the Naval Discipline Act, the British Admiralty and Dominion Governments will communicate to each other

any changes which they propose to make in these Regulations or that Act.

The Schedules A and B defined the stations of Canadian and Australian ships respectively. These stations cover the territorial and contiguous waters in each case. The agreement generally seems framed in an exceedingly able and statesmanlike spirit, designed so far as may be to avoid any possible friction or misunderstanding in the future, and in preparation for the day when the Imperial British Fleet shall be something very much more than a dream or just a fancy.

This chapter merely records the birth of something the end of which none can foretell. It may be the first hint of a great world-wide English-speaking confederation: it may be the swan song of the British Empire. But it is probably one or the other in full measure.

VIII.

GENERAL MATTERS IN THE LAST HUNDRED YEARS.

SINCE the Great French Wars the British Navy has altered out of all recognition in its *materiel;* but changes in the *personnel* are often considerably less than appears on the surface.

To take matters in the same order as they are taken in Chapter VIII, Vol. I., uniform has, of course, long established itself. It has done so with a formality which, in the view of many, has "established the régime of the tailor rather than the sailor." Within the last few years a slight change for the better has occurred; but of the greater part of the period so far as concerns purposes for which uniform was first introduced—the sailor and tailor exchanged places. Much has been written about admirals and captains whose ideas of naval efficiency were limited by "spit and polish,"* but "spit and polish" at its worst was never so bad as that tailoring idea which was the ultimate result of George II admiring the costume of the Duchess of Bedford.†

The mischief is popularly supposed to lie with naval officers. Actually its roots lie with officials, who have piled regulation upon regulation, and the Vanity of Vanities is to be found so far back as the days of the great St. Vincent and his recorded orders about officers

* See Vol. I., Chap. III. No less a man than Sir Francis Drake appears to have invented "spit and polish."

† See Vol. I., page 194.

Photo] [Stuart, Southsea.

ADMIRAL FISHER.

shoe-laces. Lesser lights than he, being in authority, blindly imitated. And so the uniform fetish grew and prospered.

This is not to be taken wholly as a condemnation—for all that a system which made one of the most important duties of a lieutenant to be the carrying round of a tape measure with a view to ascertaining whether every man was "uniform" within a fraction of an inch may seem more suggestive of comic opera than of naval efficiency. Within reasonable limits, conformity has many virtues; and a man slovenly in observing uniform regulations is likely enough to be slovenly in things of greater moment. Like most bad things in the Navy, the principle was ideal: only the carrying of it too far was at fault. There is not the remotest reason to believe that a Navy not in uniform would be as efficient as one in uniform—all the probabilities are that it would be less so. The man who invented the saying that "a pigmy in uniform is more impressive than a giant in plain clothes" was making no idle statement, but stating a general verity. The trouble is solely in the difficulty that has ever been experienced in striking a common-sense mean—a difficulty created by the first mediocrity who tried to stand in St. Vincent's shoes, and who lacked the brains to realise that what St. Vincent had started with a definite Service object in view, he—the unknown mediocrity—had merely lost in the *means* An example once created had to be followed. The hardships of conformity—of which overmuch is heard nowadays—are actually trivial, on account of the custom. The mischief lies not in the conforming, but in the waste of time of those who are made responsible for that conformity.

In essence, modern uniform is simple enough: that the various ranks should be noted by special insignia is obviously desirable. For combatant officers, the distinguishing sleeve-marks are:—

Admiral Vice-Admiral Rear-Admiral Commodore Captain Commander Lieutenant Commander Lieutenant Sub-Lieutenant

Engineer officers wear the same insignia with purple between the stripes. Non-combatant officers are without the curl to the stripes, and wear colours to distinguish them as follows:—Doctors, red; Paymasters, white; Naval Instructors, blue.

The system for the supply of the *personnel* is to-day altogether different from what it was a hundred years ago. Till comparatively recently future deck officers were taken very young, passed into the Service as Naval Cadets, and thence promoted up to Midshipmen, etc., while Engineers and officers of the other civilian branches joined later in life.

More or less contemporaneously with the Dreadnought era this was altered by the "New Scheme of Entry," also known as the "Selbourne Scheme," after the then first Lord of the Admiralty, but really the creation of Admiral Fisher, the Sea Lord who was the moving spirit at the Admiralty at that time.

Few schemes have been more virulently criticised—few, in some cases, more unfairly. Like nearly all Admiral Fisher's innovations, the scheme was better on paper than in fact. Like all his other schemes it was carried through at far too great a pace for the ultra-conservative moods of the British Navy, which has ever resented anything but the most gradual of changes. On the other hand, it is too often forgotten by critics that a great agitation on the part of naval engineer officers, backed by very considerable shore-influences, was then in existence. Something had to be done, and done quickly. Of Admiral Fisher it may ever be said that he acted where others merely argued.

Under the New Scheme, the deck-officer, the engineer, and the marine-officer were all to enter as cadets at a very tender age, undergo a common training, and be specialised for any Branch at option or at Admiralty discretion later on.

Whatever may be said against the New Scheme, it was magnificent on paper. Engineer officers had first come into the Navy as mechanics to work an auxiliary motive-power in which no "seamen" had much faith. From that humble beginning the status of their Branch grew and grew, till both motive-power and the existence of nearly everything on ship-board depended on the engineers. At the same time the official status of the Branch remained practically in the same stage as it did when the first few "greasers" were entered. The deck-officer was (nominally, at any rate) drawn from the aristocracy; the engineer officer from the democracy in a great measure. In so far as this obtained, "social war" was added to the real issue. It was obvious that this state of affairs was detrimental to naval efficiency Something had to be done.

Admiral Fisher cut the Gordian knot in his own fashion. In substance his Scheme provided that future engineer officers were to be drawn from the same class as deck-officers—to gild the pill, marine officers were flung into the same melting pot. He might have done better: but far more conceivably harm might have been perpetrated.

As an argument behind him, he had Drake and Elizabethan conditions, the history of the days when every man was made to "sail his ship and fight it too." The U.S. Navy had already plunged on a somewhat similar experiment. When the Russo-Japanese War came, the Japanese, in the middle of a life-and-death fight, suddenly granted executive rank to their engineer officers—*i.e.*, that right to control and punish their own men which British marine officers have always had.

The Scheme met its first rock in the Marines. For three hundred years or thereabouts the "Sea Regiment" has been afloat as a thing apart. The "leather-necks"—as the sailors call them—have built up their own traditions. They have ever remained a force apart from both Army and Navy, belonging to both and yet to neither. The record of the Marines is such that when, recently, it was proposed that they should have a regimental colour with their battles emblazoned on it, the idea had to be abandoned because there was not room on the flag for their services!

Any attempt to interfere with the continuity of such a corps was fore-doomed to failure from the first. The Marines resisted being turned into sailors just as they would have resisted being turned into soldiers. They stood out uncompromisingly for being "the Sea Regiment." The expected happened. By 1911 this part of the New Scheme was practically shelved, and the most unique body of men in the world was left to carry out its own traditions.

In the matter of future engineers, snags were struck likewise, but here a more or less unreasoning conservatism

Photo] [Russell & Sons, Southsea

ADMIRAL SIR JOHN JELLICOE.

on the part of parents played its full part. The average parent objected to his son becoming an engineer specialist over old-time reasons. A further and weightier objection was, and continues to be, raised by engineering experts, who argue that engineering is a life profession, not to be picked up efficiently by casual specialization.

The matter is still under discussion, and its verification or otherwise rests with the future. As to the first point, a serious effort to overcome it was made early in 1912 by the promulgation of an order that New Scheme officers, specialised for engineering, would be eligible for the command of submarines equally with deck-officers.

The importance of this particular point is great; for by the end of 1911 it was generally believed that the motor warship would at some more or less early date in the future replace the steam-driven one; and so the "sail-his-ship-and-fight-it-too" theory found a new interpretation.

As regards the rank and file of the Navy, the difference of a hundred years has been so great and so commented on that to-day we perhaps tend to make it, seem far greater than it really is. It is to be doubted whether the "prime seaman" has altered to anything like the extent imagined. We are all too prone to forget that in the days of the Great French Wars *all* the crews were not jail-birds, pressed-men, and riff-raff. The leaven of the mass were the "prime seamen," who, in their own way, were as well trained for the naval service as are the bluejackets of to-day.

Since then the "prime seamen" have had many vicissitudes. So long ago as the time of the Crimean War men of ten years' continuous service were in existence, but whatever the "paper" value of this force may have been, the extracts given in Chapter viii, Vol. I, make it abundantly clear that the "prime seaman" was in practice very scarce. It is long since then that the long service system was built up.

Under this every bluejacket was a "prime seaman" either in *posse* or in *esse*. He was entered for a period of ten years, with option to re-engage for a further ten years at slightly increased pay and a pension on retirement. At a later and comparatively recent stage this total of twenty years got increased to twenty-two years. The prospects were improved to the extent that the best men of the Lower Deck upon reaching Warrant Rank were able, towards the close of their careers, to reach the rank of lieutenant on the Active List. In a word, the idea of a Navy consisting entirely of "prime seamen" was more or less actually reached.

This system had, however, one drawback. It was, relatively speaking, very expensive. When the Fisher revolution took place Economy was very much the motto of the day. It was pointed out that outside the Royal Naval Reserve, consisting of merchant seamen, no effective reserve existed. It was further pointed out that on board a modern battleship there were many duties which could just as well be performed by partially trained or even untrained men as by skilled men.

Out of these two points (according to some critics), by using the first as a cloak for the economy of the second, a certain retrogade movement was established in the institution of the Short Service System. Under this the old time "landsman" was revived under another name. Under the Short Service System a man could enter the Navy for five years, receiving ordinary pay for ordinary duties, but without prospects of promotion or pension, except in so far as he might afterwards be utilised for reserve purposes.

How far this scheme made for efficiency is a moot point, but it certainly led to economy. As certainly it was bitterly resented by the men of the Navy. The views of the officers on the subject of "ticklers"—as Short Service men were termed afloat—were less decided. Some considered the scheme an abomination; others thought it very satisfactory.

With so conservative an institution as the British Navy, it is yet too early to give a definite decision one way or the other on the subject. But it is worth noting that no one seems to have remarked on the fact that it was a tentative return, under modern and peace conditions, to what obtained in the days of the Great French Wars, and then at least satisfactorily answered requirements.

No one really knew, and no one could do more than surmise, what would be required for manning the Fleet in the next great war in which the British Navy was engaged. It was generally assumed that in the present century the re-institution of the press-gang would be quite impossible owing to public opinion.

Public opinion, however, is a variable quantity, and with a Navy in desperate plight for men there is no saying definitely what might or might not happen, either publicly or *sub rosa*. It was generally agreed on all hands that, large as the trained *personnel* of the British Navy is, it might prove totally inadequate in a big naval war. In such case extra men would have to be found—sentiment or no sentiment. The Short Service System, despite all its drawbacks, has so far proved a loophole to avoid the horrors of the press-gang of the old days; and much which on the face of it was at the time obviously unsatisfactory may in the future prove to have been foresight of an unexpectedly high order.

It only remains to add that nothing of this sort has ever been advanced in extenuation by advocates of Short Service, who have confined themselves entirely to the obvious point of economy and the more or less debatable point of an efficient reserve.

To-day, of course, the crews do not find their ships a prison; but it is a moot question whether they are relatively much better off than in Nelson's day. A great deal of leaven is give—far more, indeed, than is represented by philanthropic agitators—but it is mainly of the nature of "short leave." This—in these days of travel—means very little relatively, since it rarely allows of a trip home. For good or ill, the bluejacket of to-day is a "home-bird"; consequently, what a hundred years ago would have represented "ample liberty," to-day appears much on all fours with the old time confinement to the ship. Modern facilities for travel have swallowed up most of the difference! This is among the matters not understood by the Powers That Be. The perspective has changed; and Service Conditions have not yet been fully accommodated to the alteration.

Food remains a source of naval grievance to-day almost as much as in the days of the Great Mutiny. That it does so is mostly an inherited tradition of the past; for both quality and quantity are now excellent. An impression prevails, however, that were messing provided by the Admiralty on non-profit lines instead of by contract, "extras" would either be cheaper, or that what are now "canteen profits" on them would be more available than they are at present. There is little reason to believe that this is so. Like the purser of a hundred years ago, the modern contractor probably does not make a tenth of the profit that he is legendarily supposed to make, nor is there any clear proof that things could be materially bettered, except in details which have little or nothing to do with the main point.

When all is said and done, the bluejacket of the Twentieth Century has always been fed as well or better than his brother in civilian life, and his growls upon the subject of messing do not demand any very serious attention. Just as the Great Mutiny of 1797 brought about an attention to details of uniform, regulations and things of that sort which have ever since endured, so it perpetuated a corresponding impression that an official eye must ever be directed to keeping messing more or less up to the mark. And that eye has never slumbered.

In Chapter VIII, Vol. I, a page is devoted to surgery in the Great War Era. Here, as in some other matters, progress may be more real than imaginary. Now, as then, the Navy offers little in the way of lucrative inducements to a good surgeon. In one sense it offers less than it did ; for, though exceptions can be found, the general naval conception of the doctor is still the old-fashioned notion of someone to cure the sick man rather than the more modern idea of preventing the man from becoming sick.

The problem, it must, however, be admitted, is a difficult one in many ways. In peace conditions the medical staff is rather too large than too small ; for all that, for modern war conditions it is probably hopelessly inadequate.

It is more or less accepted that in modern battle the wounded must lie where they fall. Theoretically, at any rate, this is mitigated by certain instructions in First Aid, and the furnishing of hypodermic syringes to one member of each gun's crew for use on the badly wounded. The days when lint was forbidden as a useless extravagance, and sponges were restricted for the sake of economy, have indeed gone, just as surely as has the old-time surgeon who, unable to afford his own instruments, had to borrow from the carpenter an ordinary saw to amputate a limb! But—relatively to shore-practice of equal date—the naval medical service is not much less hampered than it was a hundred odd years ago; and a really big naval action is likely enough to see as much superfluous agony (relatively speaking) as in the old days!

The true position of the surgeon in a warship is not recognised; the official duties of a doctor are officially purely "curative," very rarely "preventive." Some or most of this is due to the prevalence of old-fashioned obsolete ideas in high quarters; but some also is to be laid at the door of the "Churches," and their fancy for differentiating between diseases. The matter is not one that admits of further discussion here; but the enforcement upon naval surgeons (who have to deal with large bodies of men crowded into spaces necessarily favourable for contagion) of conditions which, rightly or wrongly, are deemed to be for the public's ultimate welfare on shore, are a terrible menace to naval efficiency. Things are indeed bettering in this respect, but still somewhat slowly.

After the Great Mutiny of 1797 the pay of the men was approximately trebled. Although "extras" have since been added, the normal pay has remained to all intents and purposes stationary, while if qualifications be taken into account it has actually decreased, since the "ordinary" of to-day is called on to do just about what the "able seamen" of a hundred odd years had to do.

The respective rates* are :—

	1797 per week.	1914 per week (minimum).
Ordinary seamen	6/6	8/9
Able seamen..............	8/4	11/8

Since the cost of living has certainly gone up at least twenty per cent. in the interim, and since the normal increase is undoubtedly under that, a *prima facie* case is certainly made out for those who contend that the British sailor is, if anything, worse paid than he was a hundred years ago.

The board and lodging which he obtains of course adds to the actual total ; but the fact remains that the board and lodging labourer of to-day, who takes no risks of his life, is now as much ahead of the sailor as he was behind him in 1797. And "uniform" means a heavy extra expense for clothing.

In 1912 the men of the Navy definitely asked for a twenty per cent. increase of pay. It amounted to nothing but an adjustment of 1797 conditions to modern ones. They did not obtain it—unasked for off-chances of "Democracy on the Quarter Deck" were given instead. Later on a 3d. a day concession was made to able seamen after the completion of six years' more service.

There at the moment the question remains. It has to a certain extent been obscured by question of naval punishments ; about which a good deal of nonsense has

* The minimum is given in each case.

been written by people who in some cases should know better.

Naval punishments are severe; but discipline necessitates punishments, and these have been regularly toned down to the spirit of the age. The real and genuine grievances of to-day are almost identical with the genuine grievances of which the "prime seamen" complained in 1797:—pay, leave, and the treatment of men who happen to come into the hands of the ship's medical staff through no fault of their own.

In 1912 a Commission was enquiring into punishments, and further reductions in them to suit modern ideas resulted; but it is by no means certain that any advantage in efficiency will be acquired therefrom. Naval Discipline—no matter how harsh—is a tricky thing to tamper with. The highest possible ideal of Discipline was reached by the Japanese, who, previous to the war with Russia, ran their Navy on "the honour of the flag" lines; and presumably had some similar system in the Army. In what is certainly the most patriotic land of our era this succeeded in peace time. Yet in the attacks on Port Arthur, when a great assault was made, when the time came to cease bombarding the hostile position, the guns were turned on the possible line of retreat, ensuring that for a man to retire was more dangerous to him than to go forward. In the case of the Japanese it was perhaps an unnecessary precaution, but it was borrowed from old-time precautionary usage in Europe.

Every system of discipline is based on the fact that either sooner or later there will be some man who will be frightened enough to turn tail, and lead others to follow his example, unless there is something still worse to stop him. On this foundation stone the most seemingly trivial items of discipline are based.

No normal man, *when it comes to the point*, cares to risk his life or limbs. Here and there an individual of the "don't care" order is to be found; but generally speaking he is an anomaly. In the ordinary way the safest assumption is that he will think more of his skin than anything else—and on this theory all systems of discipline are founded. All rely on the ultimate fact that "it is worse to go back than to go forward." The curse of the present age is the semi-educated humanitarian who criticises the *means* (often crude enough) without taking the *end* into proper account. At the other extreme are those who, though familiar with the story of the Russian sentry regularly placed to protect a favourite flower which had died two hundred years before, understand that there is a *reason* for everything, but fail to realise fully that conditions change.

Many works have been written on the tactical and strategical superiority of those who have led British Fleets to victory; but in the great majority of cases there is little to show that the majority of our admirals were really more clever than many of their opponents. He would be a bold man who set out to prove in black and white that Collingwood had more brain than Villeneuve, or would have done better than that unlucky admiral had they changed places with each other. Nor would he have much more luck in attempting to prove that at any era in history British sailors were really braver than French ones.

In one critical period of English history Drake appeared—and the most lasting sign of "how he did it" was "spit and polish"! In another dark time came

St. Vincent—and his sign manual was "tailoring" and "routine." In yet another critical hour came Nelson who supplied enthusiasm by his care for the health of his men. But it was Nelson who went out of his way to congratulate St. Vincent on hanging mutineers out of hand on a Sunday instead of keeping them till the Monday! These three great men knew what they relied upon.

The real secret of British naval success has surely lain in the possession of naval architects able to create the kind of ship best calculated to stand hammering, and hard-hearted folk in authority who created a discipline which, however unreasonable some of it may now seem, has ever ensured victory.

Superior British courage then, as now, was a pleasing topic for the music hall or its equivalent; but the real driving power of the British battle fleet in the past was "discipline." Those who to-day would amend or alter even the most seemingly ridiculous anomalies of discipline will do well to ponder and walk warily, lest they upset greater things than they wot of—lest they damage the keystone embodied in the crude words of that unknown stoker who said: "It's just this—do your blanky job."

WARSHIP NICKNAMES

PAST AND PRESENT.

Achilles	A-chilles, *also* The Chilly
Aeolus	Oily
Anson	Handsome
Agamemnon	Aggie, *also* Mother Weston
Alexandra	Alex
Ajax	Queen of Hearts
Andromache	Andrew Mark
Apollo	Pollie
Ariadne	Harry Agony, *also* Hairy Annie
Bacchante	Boozer, *also* Black Shanty
Belleisle	Belle-isle
Bellerophon	Bellyfull
Black Prince	British Public
Brilliant	Hair Wash
Caesar	Gripes
Calliope	Cally-ope
Cambrian	Taffy
Camperdown	Scamperdown
Circe	Sirse
Collingwood	Collywobbles
Colossus	Costly
Conqueror	Corncurer

Cornwallis	.. ..	Colliwobbles
Cumberland	.. ..	Cumbersome
Curacoa	.. ..	Cocoa
Curlew	.. ..	Curly
Cyclops	.. ..	Sickly
Daphne	.. ..	Duffer
Devastation	.. ..	Devy
Diana	.. ..	Die Anyhow
Dido	.. ..	Diddler
Donegal	.. ..	Don't Again
Duke of Wellington	..	The Dook
Dreadnought	.. ..	Fearnought
Endymion	.. ..	Andy Man
Fantome	.. ..	Ghost
Galatea	.. ..	Gal to Tea
Gibraltar	.. ..	Gib
Glory	.. ..	Ruddigore
Gorgon	.. ..	Guzzler
Grasshopper	.. ..	Grass Bug
Hannibal	.. ..	Annie Bell
Hawke	.. ..	Awkward
Hecate	.. ..	Tom Cat
Hercules	.. ..	Her-cules
Hermione	.. ..	Hermy-one
Highflyer	.. ..	Aeroplane
Hindustan	.. ..	Dusty One
Hogue	.. ..	Road Hog
Howe	.. ..	Anyhow
Illustrious	.. ..	Lusty
Immortalité	.. ..	Immortal Light, *also* Immorality
Imperieuse	.. ..	Impy
Indefatigable	.. ..	Antipon

Iphigenia	Silly Jane
Isis	Icy
Jupiter	Jupes
King Alfred	Alfie
King Edward	Neddie, *also* King Ned
Lancaster	Lanky
Leda	Bleeder
Lion	Liar, *also* Lie On
Magnificent	Maggie
Melpomene	Melpo-mean
Montagu	Montie
Narcissus	Nasty Sister
Niger	Nigger
Nile	Jew
Northampton	Northo', *also* Bradlaugh
Northumberland	Northo'
Onyx	Only One
Pandora	Paddler
Penelope	Penny Lope
Perseus	Percy
Philomel	Filly
Polyphemus	Polly
Prince George	P.G.
Psyche	Sue, *or* Sukey, *also* Sickly
Queen Elizabeth	Black Bess, *also* Bessie, *also* Lizzie
Ramilles	Mutton Chop
Rattlesnake	Ratto
Repulse	Beecham
Resolution	Reso
Royal Sovereign	Royal Quid
Salamander	Sally and her Ma
Sanspareil	San Pan

Scylla	Silly
Seagull	Gull
Sheldrake	Shell Out
St. Vincent	Saint
Sutlej	Suble J.
Tartar	Emetic
Téméraire	Temmy
Terrible	Orrible
Undaunted	Dauntless
Yarmouth	Lunatic
Warspite	War Spider

Note.—From time to time Nicknames vary, as occasionally they are bestowed by other ships. This list is not quite complete on that account

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THE END.

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