ship’s bottom, are the only pieces which need be prepared according to this system for each ship, the whole of the remainder being available for every launch. A space of about half an inch is left between them and the balk timber placed beneath them, as it is not intended that the ship should bear on these balk timbers in launching, but merely be supported by them in the event of her heeling over. The ship, therefore, is launched wholly on the sliding-plank *c*, fitted under the keel.

If a ship is coppered before launching, so that putting her into a dry-dock for that purpose becomes unnecessary, it is then desir­able that she should be launched without any cleats attached to her bottom. The two sides of the cradle are prevented from being forced apart when the weight of the ship is brought upon them by chains passing under the keel. Each portion of frame-work composing the launch has two of these chains attached to it, and brought under the keel to a bolt which passes slackly through one of the poppets, and is secured by a long forelock, with an iron handle, reaching above the water-line, so that when the ship is afloat it may be drawn out of the bolt. The chain then draws the bolt, and in falling trips the cradle from under the bottom. There should be at least two chains on each side secured to the fore-poppets, two on each side secured to the after-poppets, and two on each side to the stopping-up, and this only for the launch of a small ship ; in larger ships the number will necessarily be increased according to the weight of the vessel and the tendency that she may have, according to her form, to separate the bilgeways. This tendency on the part of a sharp ship by a rising floor, or by her wedge- shaped form in the fore and after bodies, is great, but there is not much probability of a ship heeling over to one side or the other.

The importance of the work of the designer cannot be too highly estimated. Unfortunately there is, as has been said, “slop work ” in designing as well as in putting the structure together. There is often an absence of any attempt at precautions where multiplied accidents have shown them to be necessary, as well as inconceivable carelessness in the details rendering provisions for security, where they exist in principle, useless in practice.

In the *Report* of the Royal Commission on Unseaworthy Ships, dated September 22, 1873, we read as follows :—“Competent wit­nesses state that many merchant ships are built with bad iron, that they are ill put together, and sent to sea in a defective condition. It is also said that they are frequently lengthened without addi­tional strength, and are consequently weak ships. The number of iron steamers which have been lost in the last few years, many of them having been surveyed and classed under the London or Liverpool registers, raises a question whether the regulations of these registers are sufficiently stringent to insure good ship­building. The directors of the Bureau Veritas have deemed it necessary to revise the rules of their register, and to increase the scantling. In the race of competition among shipbuilders it is probable that inferior materials and bad workmanship are ad­mitted into ships.”

The Commissioners on Unseaworthy Ships, referring to the proposal that the Board of Trade should superintend the con­struction, the periodical inspection, the repair, and the loading of all British merchant ships, said: “We consider it to be a question worthy of serious consideration, whether, in the case of passenger ships, the certificate of the Board of Trade, so far as regards specific approval, should not be expressly confined to the number of passengers to be allowed and to the accommodation for their health, comfort, and general security,—all questions of unseaworthiness of hull, machinery, and equipment being left to the owners, subject only to a general power of interference

in case of danger sufficiently apparent to justify special inter­vention.”

Where ships have to meet the stress of battle as well as that of the sea faithfulness of work is even more imperative. It is not only necessary to have perfect work, but there must also be multiplied safeguards and provisions against damage by shot, shell, ram, and torpedo as well as against the enemies which are common to all ships. In the article Navy the peculiarities of the ship of war are described. Regarding them here simply as ships, they may be said to be distinguished neither by size nor speed. They have been far outstripped in size, the longest English ship of war built within the last twenty years being only 325 feet in length, while there are Atlantic passenger ships 200 feet longer. They have also been outstripped in speed. The highest speed ever attained in a vessel of war is that of the “ Iris ” and “ Mercury”; and as they are only 300 feet long it is easier in vessels of greater length to get higher speeds with less engine power, and easy also to maintain it in a seaway both as a question of form and power, and also as a matter of coal endurance. The following table gives the relative dimensions of large 14-knot ships :—

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Ship's Name. | Length divided by Breadth (on Water Line). | I.H.P. | Dispt. in Tons. | (Dispt.)2/3 |
|  | “Adriatic,” | ft. in.  435 7/41 8 = 10·45 |  |  |  |
|  | (White Star Line) | 3,600 | 8,250 | 408∙3 |
|  | H.M.S. “Dreadnought,” | 333 3/61 6 = 5·42 | 8,000 | 10,886 | 491∙2 |
|  | H.M.S. “Sultan,” | 330 0/58 6 = 5·64 | 8,600 | 9,286 | 441∙8 |
|  | H.M.S. “Inflexible,” | 324 0/75 0 = 4·32 | 8,000 | 11,500 | 509∙5 |
|  | H.M.S. “Neptune,” late “Independencia,” | 304 0/60 10 = 5·01 | 8,500 | 9,063 | 434·7 |

The differences between the amount and complexity of fitting in the ship of war and the merchant ship are represented by the greatly increased cost per ton weight of hull. It must, however, be premised that the war ship has the weight of hull kept down to a very low standard to enable her to carry her offensive and defensive equipment,—far lower than is usual in the merchant ship. The first-class merchant ship costs £28 per ton weight of hull and about £13 per indicated horse-power for the engines. The ship of war built by the same builders under contract with the Government costs from £60 to £65 per ton weight of hull for unarmoured ships, and from £70 to £75 or more for armoured ships. In the case of an unarmoured vessel, having a protecting deck over machinery and magazines, recently ordered, the prices were as follows :—

General average £60 10 0 per ton weight of hull.

Average of three London firms. 66 0 0 ,, ,,

Accepted tender 57 6 0 ,, ,,

The engines for the same vessel were :—

General average £15 8 0 per I.H. P.

Average of three London firms 17 5 0 ,,

Accepted tender 11 8 0 ,,

In the case of a larger armoured ship the rates were :—

Average price per ton weight of hull £81 2 0

Accepted tender 71 5 0

Average price per I. H. P. of engines @@1 11 1 0

Accepted tender 10 7 0

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Distribution of Materials and Cost in Various Types of Ships.* | | | | | | | |
|  | First-  Class  Passenger  Steamers. | Cargo  Steamers. | Armoured  Battle  Ships  (Barbette). | Protected 17-Knot Ships. Unarmoured, Unmasted, and Unsheathed. | Protected  13-Knot Ships. Unarmoured, Masted, and  Sheathed. | Protected  10 to 12 Knots. Unarmoured,  Masted, and  Sheathed. | Torpedo  Boats,  19 to 20 Knots. |
| Length in feet | 450 | 390 | 325 | 300 | 225 | 170 | 86 |
| Displacement at load draft (in tons) | 9550 | 6800 | 10,000 | 3630 | 2420 | 1153 | 31∙3 |
| Weight (in tons) of hull, excluding armour | 3800 | 1960 | 3,520 | 2000 | 1270 | 616 | 11∙6 |
| ,, ,, armour |  |  | 3,100 @@2 | 218 | 152 |  |  |
| ,, ,, propelling machinery | 1310 | 240 | 1,060 | 485 | 342 | 135 | 11·0 |
| ,, ,, guns, mounting, and ammunition |  |  | 840 | 285 | 154 | 77 | 2·75 |
| ,, ,, fuel, at usual draft | 1500 | 600 | 900 | 500 | 270 | 130 | 3∙ |
| Cost of hull per ton of its weight | £32 | £20 | £81·2 | £56 | £67·25 @@3 | £60 | £280 |
| ,, propelling machinery, per ton of its weight | £60 | £50-55 | £105 | £111 | £853 | £90 | £373 |

The use of heavy ordnance in recent times as the sole weapon for naval warfare brought about a marked distinction between the merchant vessel and the war ship, which had not previously existed. The revival of the ram and the adoption of the torpedo tend to abolish this distinction and to bring about an approxima­tion again.

It is difficult to say what, in the very near future, will be the

distinguishing characteristics of the ship of war. They will not be speed or size or coal endurance, or the power of striking with the ram, the torpedo, or the gun. It will be quite easy to arm merchant ships with these weapons, and some of these ships

@@@1 The indicated horse-power referred to here is that obtained by natural draft @@@2 Of this the vertical armour (costing before it is worked up, £70 to £90 per

ton) is nearly 2000 tons. @@@3 Average of six vessels built by Elder.