bolted to them under either extremity and both within and without, and ran to the ship’s side. Above the curvature of the upper waling- pieces into the ***τrpoeμβ6λu>v*** were the cheeks of the vessel, generally painted red, and in the upper part of these the eyes ***(όφθαλμοί),*** answering to our hawse holes, through which ran the cables for the anchors. On either side the trireme, at about the level of the thranitic benches, projected a gangway (πάροδοί) resting against the ribs of the vessel. This projection was of about 18 to 24 in., which gave a space, increased to about 3 ft. by the inward curve of the prolongation of the ribs to form supports for the deck, for a passage on either side of the vessel. This gangway was planked in along its outer side so as to afford protection to the seamen and marines, who could pass along its whole length without impeding the rowers. Here, in action, the sailors were posted as light-armed troops, and when needed could use the long supernumerary oars ***(πtpiveψ)*** mentioned above. The ribs, prolonged upwards upon an inward curve, supported on their upper ends the cross beams **(στpωτ⅞pes)** which tied the two sides of the vessel together and carried the deck. In the cataphract class these took the place of the thwarts (67α) which in the earlier vessels, at a lower level, yoked together the sides of the vessel, and formed also benches for the rowers to sit on, from which the latter had their name (ϙϊ), having been the uppermost tier of oarsmen in the bireme; while those who sat behind and below them in the hold of the vessel were called 0αλαμtτou or 0aλ0μaκcs (from ***Θάλαμος).*** In the trireme the additional upper tier was named from the elevated bench ***(Θpavoς)*** on which they were placed ***(Θpavtτaι).*** On the deck were stationed the marines (⅛ι0αται), fighting men in heavy armour, few in number in the Attic trireme in its palmy days, but many in the Roman quin­quereme, when the ramming tactics were antiquated, and wherever, as in the great battles in the harbour at Syracuse, land tactics took the place of the maritime skill which gave victory to the ram in the open sea. The space occupied by the rowers was termed 2γκωπop. Beyond this, fore and aft, were the ***τraptζttpkσtat,*** or parts outside the rowers. These occupied about 12 ft. of the bows and 15 ft. in the stern. In the fore part was the forecastle, with its raised deck. In the stern the decks ***(tκpιa)*** rose in two or three gradations, upon which was a kind of deck-house for the captain and a seat for the steerer ***(κvβtpyhτης)r*** who steered by means of ropes attached to the tillers fixed in the upper part of the paddles, which, in later times at least, ran over wheels (***fτpoχ***ιλf<∏), giving him the power of changing his vessel’s course with great rapidity. Behind the deck-house rose the flagstaff, on which was hoisted the pennant, and from which probably signals were given in the case of an admiral’s ship. On either side of the deck ran a balustrade *(cancelli),* which was covered for protection during action with felt *(cilicium,* ***πapappbμaτa τριχινά)*** or canvas (τ. λίυκά). Above was stretched a strong awning of hide (κατA3λ∏μα), as a protection against grappling irons and missiles of all kinds. In Roman vessels towers were carried up fore and aft from which darts could be showered on the enemy’s deck; the heavy corvus or boarding bridge swung suspended by a chain near the bows; and the ponderous ***faλφiς*** hung at the ends of the yards ready to fall on a vessel that came near enough alongside. But these were later inventions and for larger ships. The Attic trireme was built light for speed and for ramming purposes.

The dimensions of some dry docks discovered at Munychium and Zea, “ ship-houses ” as the ancients called them, afford some indica­tions as to limitations of length and breadth in the Attic ships that used them. The measurements indicate for these houses about 150 ft. in length and 20 ft. in breadth. We may infer, therefore, that the ships housed in them did not exceed 150 by 20 ft. But there must necessarily have been some spare room in the dock houses, on either side and at both ends. Allowing 2 ft. on either side for passage room, and 10 ft. at either end, we should have room for a vessel of about 130 ft. in length including the beak, and of about 16 ft. beam. Adopting the 2 cubit “ interscalmium,” the rowing space in the trireme (31 by 3) for the upper tier would equal 93 ft. Allowing 12 ft. for bows and 15 for stern and 10 ft. for beak, we have 130 ft. as the aggregate length of the war vessel of three banks of oars. This of course is conjectural, but we submit that it is a reasonable con­jecture from the evidence which we possess. There was indeed every reason for keeping the vessel as short as was compatible with the necessary requirements, and it is to be remembered that it was constantly being hauled up on shore for the night and launched again in the morning. As to the “ interscalmium,” it does not appear to exceed 3 ft. even in the largest boats now used in the royal navy. In the Chinese dragon boats, which are 73 ft. long and under 5 it. beam, and have each 54 rowers or paddlers, it does not exceed 2 ft. 6 in. An oarsman whose feet are nearly on a level with his seat, as in **a** modern racing eight, requires more room for the swing forward of the handle of his oar in the recovery, than a man whose feet rest on a level well below that of his seat. It is not likely that the ancient oarsman swung forward more than blue-jackets do now-a-days in a man-of-war’s cutter. All the Attic triremes appear to have been built upon the same model, and their gear was interchangeable. The Athenians had a peculiar system of girding the ships with long cables (νπο^ώματα), each trireme having two or more, which, passing through eyeholes in front of the stern-post, ran all round the vessel lengthwise immediately under the waling-pieces. They were fastened at the stern and tightened up with levers. These cables, by shrinking as soon as they were wet, tightened the whole fabric of

the vessel, and in action, in all probability, relieved the hull from part of the shock of ramming, the strain of which would be sustained by the waling-pieces convergent in the beaks. These rope-girdles are not to be confused with the process of undergirding or trapping, such as is narrated of the vessel in which St Paul was being carried to ltaly. The trireme appears to have had two masts. In action the Greeks did not use sails, and everything that could be lowered was stowed below. The mainmasts and larger sails were often left ashore if a conflict was expected.

The crew of the Attic trireme consisted of from 200 to 225 men in all. Of these 170 were rowers—54 on the lower bank (thalamites), 54 on the middle bank (zygites), and 62 on the upper bank (thranites), —the upper oars being more numerous because of the contraction of the space available for the lower tiers near the bow and stern. Besides the rowers were about 10 marines (τr√‰αι) and 20 seamen. The officers were the trierarch and next to him, the helmsman ***(κvβtprfjτηςλ),*** who was the navigating officer of the trireme. The rowers descended into the seven-foot space between the diaphragmata and took their places in regular order, beginning with the thalamites. The economy of space was such that, as Cicero remarks, there was not room for one man more.

The improvement made in the build of their vessels by the Corinthian and Syracusan shipwrights, by which the bows were so much strengthened that they were able to meet the Athenian attack stem on *(προσβολή),* caused a change of tactics, and gave an impetus to the building of larger vessels—quadriremes and quinqueremes—in which increased oar-power was available for the propulsion of the heavier weights.

In principle these vessels were only expansions of the trireme, so far as the disposition of the rowers was concerned, but the speed could not have increased in proportion to the weight, and hence arose the variety of contrivances which superseded the ramming tactics of the days of Γhormio. In the century that succeeded the close of the Peloponnesian War the fashion of building big vessels became prevalent. We hear of various numbers of banks of oars up to sixteen *(ικκαιδeκf}pηs)—*the big vessel of Demetrius Poliorcetes. The famous tesseraconteres or forty-banked vessel of Ptolemy Philopator, if it ever existed except in the imagination of Callixenus, was in reality nothing more than a costly and ingenious toy, and never of any practical use. The story, however, of its construction indicates the per- fection to which the shipwright’s art had been carried among the ancients.

The Romans, who developed their naval power during the First Punic War, though it is clear from the treaty with Carthage, 509 b.c., that they had had some maritime interests and adventurings before that great struggle began, were deficient in the art of naval construction. A Carthaginian quinquereme, which had drifted ashore, served them for a model, and with crews taught to row in a framework set up on dry land they manned a fleet which was launched in sixty days from the time that the trees were felled. Their first attempt was, as might have been expected, a failure. But they persevered, and the invention of the “ corvus,” by means of which boarding were opposed to ramming tactics, gave them under Duilius (260 b.c.) victory at Mylae,'and eventually the command of the sea. From that time onwards they continued to build ships of many banks, and seem to have maintained their predilection for fighting at close quarters. The larger vessels with their “ turres,” or castles, fore and aft, deserved Horace’s description as “ alta navium propugnacula.” The “ corvus ” and the “ dolphin ” were ready in action to fall on the enemy’s decks, and in Caesar’s battle with the Veneti off the coast of Gaul the “ falces,” great spars with curved steel heads like a sickle, mowed through the rigging and let down the sails on which alone the foe depended for movement.

But the fashion of building big ships received a severe shock at the battle of Actium (31 b.c.), when the light Liburnian “ biremes,” eluding the heavy missiles of the larger vessels, swept away their banks of oars, leaving them crippled and unable to move, till one by one they were burnt down to the water’s edge and sank.@@1 After this experience the Romans adopted the Liburnians as their principal model, and though the building of vessels with many banks continued for some centuries, yet the Liburnian type was so far dominant that

@@@1 Merivale, *Hist, of Romans under the Empire,* c. 28.