

August. In autumn the whole plant may become of a bright red colour. It is a troublesome weed, common by roadsides and in fields, pastures, and waste places throughout Europe. An infusion of its root has been used as a remedy for ichthyosis; in large quantities it acts as a purgative. The powdered root is sometimes employed as a dentifrice. The Great Water Dock, *R. Hydrolapathum*, believed to be the *herba britannica* of Pliny (*Nat. Hist.*, xxv. 6), is a tall-growing species; its root is used as an antiscorbutic. The root of the Curled Dock, *R. crispus*, affords an ointment and decoction reputed to be cures for scabies; and the seeds of the same species have been found efficacious in dysentery. Other British species are the Sharp Dock, *R. conglomerata*, the root of which has been employed in dyeing; the Bloody-veined Dock, or Bloodwort, *R. sanguineus*; the Yellow Marsh Dock, *R. palustris*; the Fiddle Dock, *R. pulcher*; the Golden Dock, *R. maritimus*; the Grainless Curled Dock, *R. domesticus* (= *aquaticus*); and the Meadow Dock, *R. pratensis*. The naturalized species, *R. alpinus*, or "Monk's Rhubarb," was early cultivated in Great Britain, and was accounted an excellent remedy for ague.

DOCK. See HARBOURS.

DOCKYARDS. Previously to the reign of Henry VIII, the kings of England had neither naval arsenals nor dockyards, nor any regular establishment of civil or naval officers to provide ships of war, or to man them; they had admirals, however, possessing a high jurisdiction and very great power (see the article ADMIRAL). There are strong evidences of the existence of dockyards, or of something answering thereto, at very early dates, at Rye, Shoreham, and Winchelsea. In November 1243 the sheriff of Sussex was ordered to enlarge the house at Rye in which the king's galleys were kept, so that it might contain seven galleys. In 1238 the keepers of some of the king's galleys were directed to cause those vessels to be breamed, and a house to be built at Winchelsea for their safe custody. In 1254 the bailiffs of Winchelsea and Rye were ordered to repair the buildings in which the king's galleys were kept at Rye. At Portsmouth and at Southampton there seem to have been at all times depôts both for ships and stores, though there was no regular dockyard at Portsmouth till the reign of Henry VIII. It would appear, from a very curious poem in Hakluyt's *Collection*, called *The Poem of Keeping the Sea*, that Henry V. had ships, officers, and men exclusively appropriated to his service, and independently of those which the Cinque Ports were bound, and the other ports were occasionally called upon, to furnish on any emergency. By this poem it also appears that Little Hampton, unfit as it now is, was the port at which Henry built

his great *Dromions*

Which passed other great shippes of the commons.

The "dromion," "dromon," or "dromedary," was a large war ship, the prototype of which was furnished by the Saracens. Roger de Hoveden, Richard of Devizes, and Peter de Longtoft celebrate the struggle which Richard I., in the "Trench the Mer," on his way to Palestine, had with a huge dromon,—a marvellous ship! a ship than which, except Noah's ship, none greater was ever read of." This vessel had three masts, was very high out of the water, and is said to have had 1500 men on board. It required the united force of the king's galleys, and an obstinate fight, to capture the dromon.

The foundation of a regular navy, by the establishment of dockyards, and the formation of a board, consisting of certain commissioners for the management of its affairs, was first laid by Henry VIII; and the first dockyard erected during his reign was that of Woolwich. Those of Portsmouth, Deptford, Chatham, and Sheerness followed

in succession. Plymouth was founded by William III. Pembroke was established in 1814, a small yard having previously existed at Milford.

From the first establishment of the dockyards to the present time, most of them have gradually been enlarged and improved by a succession of expedients and make-shifts, which answered the purposes of the moment; but the best of them have not possessed those conveniences and advantages which might be obtained from a dockyard systematically laid out on a uniform and consistent plan, with its wharfs, basins, docks, slips, magazines, and workshops arranged according to certain fixed principles, calculated to produce convenience, economy, and despatch.

Neither at the time when our dockyards were first established, nor at any subsequent periods of their enlargement, could it have been foreseen what incalculable advantages would one day be derived from the substitution of machinery for human labour; and without a reference to this vast improvement in all mechanical operations, it could not be expected that any provision would be made for its future introduction; on the contrary, the docks and slips, the workshops and storehouses, were successively built at random, and placed wherever a vacant space would most conveniently admit them, and in such a manner as in most cases to render the subsequent introduction of machinery and railways, and those various contrivances found in large private manufacturing establishments, quite impossible, even in the most commodious of Her Majesty's dockyards.

From a brief description of the royal dockyards as they now stand a general idea may be formed of their several capacities, advantages, and defects. Taking them in succession, according to their vicinity to the capital, the first is

DEPTFORD.—Deptford dockyard was first established about the year 1513, and continued to be a building yard, as well as a large depôt for naval stores, until 1869, when it was closed as a building yard in pursuance of a recommendation of a committee of the House of Commons, which reported in 1864. The increasing size of ships of war rendered the yard unsuitable for any but the smaller types of vessels, while the continuous deposits of river mud, not only along the frontage but also in the docks and basins, rendered it a costly and decreasingly valuable place of construction. It had an interesting history. Not only were some of the most celebrated ships of the navy built there, but during the Great Plague the office of the Admiralty was removed thither from Seething Lane. Peter the Great worked in the yard as a shipwright, dwelling while at Sayes Court, the residence of Evelyn, the author of *Sylva* and of the diary not less famous than Pepys's. Evelyn was the grantee of some of the ground on which the dockyard stood, for no other consideration than that there should always be a keel laid down in the yard. Queen Elizabeth's Admiralty officials were at one time resident at Deptford; and thither went the queen in 1580 to confer the honour of knighthood on Sir Francis Drake, and to dine with him on board the ship in which he had circumnavigated the world.

Though closed as a building yard in 1869, in accordance with the recommendation of a committee of the House of Commons, part of the establishment, with suitable storehouses, was retained as a depôt for naval stores, and as the one place from which shipments of stores to naval depôts abroad should be made. Of the residue, part was sold to Mr Evelyn, who made the purchased part into a recreation ground for the Deptford people, and gave it to them. The rest was sold for a metropolitan meat market to the Corporation of London. When intact the front or wharf wall of this dockyard, facing the Thames, was about 1700 feet in length, and the mean breadth of the yard 650 feet; the superficial content about 30 acres. It had three slips

for ships of the line on the face next the river; and two for smaller vessels, which launched into a basin or wet dock, 260 by 220 feet. There were also three dry docks,—one of them a double dock, communicating with the Thames, and the other a smaller one, opening into the basin. The number of men employed in this yard, in time of war, was about 1500, of whom one-half were shipwrights and artificers, and the other half labourers. There were, besides, 18 or 20 teams of 4 horses each, to drag timber and heavy stores.

The proximity of Deptford yard to the capital is of great importance, in the convenience it affords for receiving from this great mart all the home manufactures and products which may be purchased for the use of the navy. It is the general magazine of stores and necessaries for the fleet, whence they are shipped off, as occasion requires, to the home yards, the outports, and the foreign stations, in store-ships, transports, coasting sloops, lighters, and launches, according to the distance they have to be sent.

The management of Deptford naval store yard is now merged in that of the victualling yard, a most complete establishment of its kind. Till 1869 this management comprised a naval captain superintendent, with a master in the navy as his assistant. Under them a storekeeper, a store receiver, an accountant, an inspector of stores, and their respective staffs, conducted the administrative duties of the place. In 1869 the Board of Admiralty, in accordance with the recommendations of a departmental committee, abolished the offices of captain superintendent and master attendant, and placed the establishment under the civilian management of the storekeeper. The naval superintendents were appointed for five years, and after that time were withdrawn to make way for others. The superintending storekeeper is appointed as a permanent officer, and under him experience is accumulated and applied in all the manufactories and other business departments of the yard. The manufactures conducted by and for the Government at Deptford comprise biscuit making on such a scale as to supply, with the yield of the victualling yards at Gosport and Plymouth, biscuit enough for the whole navy, and also chocolate making, mustard making, flour grinding, and the operations of a large cooperage. Most of the salt beef required for the navy is salted and put up there. Deptford may be called the heart of the victualling service. From its stores are shipped the whole of the consignments required for replenishment of depôts abroad, as well as the requirements of the other two victualling yards in England, except that at the last-named the supplies of biscuits and flour are provided on the spot. The number of men employed at Deptford necessarily varies. During war upwards of a thousand men are required. The space occupied by the victualling yard is about 19 acres. There is a river frontage of 1700 feet, and a mean depth of 1000 feet.

In 1877 there are employed in the naval store and victualling yard at Deptford 258 men on the establishment, and 390 men on the hired list, at a cost of £25,847.

WOOLWICH DOCKYARD.—This no longer exists as a naval station. Though retaining its name, it remains as a depôt in the hands of the War Department, for whose work its river frontage of 3680 feet, and its docks and basins, afford excellent accommodation. Woolwich was the first and most ancient of all the dockyards, having been established in the reign of Henry VII. From it have been launched some of the finest and most celebrated ships of the English navy. In 1512 the "Harry Grace de Dieu" was built, and in 1552 was accidentally burnt, there. In more modern times the "Nelson" and the "Ocean" were from Woolwich, and those latest specimens of the now extinct class of fighting ship, the "Trafalgar," "Agamemnon," and "Royal Albert." As an establishment for the building

and repair of ships, especially steam ships, Woolwich was perhaps the completest and best furnished of all the dockyards. Its power to make and repair engines and all iron work, whether of ship or fittings, was so extensive as to enable the Government, before the introduction of iron-clads, to be nearly independent of the private trade. With occupation for 1800 workmen, it was able to rely upon its own resources almost exclusively. Its proximity to London gave it other great advantages, including this, that the Admiralty were thereby enabled the more easily to supervise the constructive work for which its architects were responsible. But for the fatal operation of two causes, the increased and increasing depth of ships of war, and the continuous silting of the river into the docks and basins of the yard, Woolwich would probably have remained one of the chief dockyards. Both these causes, however, operated. The depth of the "Nelson's" hold had to be lessened in order to ensure her passing Erith; and it was stated in the *Eighth Report of the Select Committee on Finance* (1818) that "the wharf wall at Woolwich, owing to the action of the tide on the foundation, is in a falling state, and in danger of being swept into the river, it being secured only in a temporary manner; and requires to be immediately rebuilt in a direction that will preserve it from similar injury hereafter, and prevent, in a great degree, that accumulation of mud which has, in the course of the last ten years, occasioned an expense of upwards of £125,692, and would threaten in time to render the yard useless." Till 1869, however, notwithstanding the recommendations of a parliamentary committee, and the frequent urgings of members on both sides of the House of Commons, Woolwich yard was kept open. Then, in accordance with a policy long commended, it was closed, steps were taken to dispose of the plant and material that remained, and the place itself was handed over, with its workshops and factories, to the War Department in 1872.

WOOLWICH DIVISION OF ROYAL MARINES.—About the same time that the dockyard was broken up, the division of marines—no longer in contact with ships and shipping—was abolished, and its strength was distributed between the divisions at Chatham and Plymouth.

CHATHAM DOCKYARD.—This dockyard, founded by Queen Elizabeth, though not on the present site, is situated on the right bank of the Medway, to which it presents a line of wharfage extending 10,000 feet, and of embankment 4500 feet more. The superficial contents may be estimated at about 500 acres. The old part of the yard has seven building-slips on the front, from which ships are launched into the river, all equal to the building of ships of the line, and three others for frigates and smaller vessels. In the same front are four dry docks communicating with the Medway. At the southern extremity of the yard is the ropery, 1248 feet in length and 47½ feet in width, in which are employed about 250 persons. It is equal to the manufacture of every description of cordage required for the naval service, including the largest size cable. The hemp houses, 306 feet long by 36 feet wide, are equal to the stowage of 1600 tons of hemp and 3000 hauls of yarn. Next to these are the slips and docks, with the working-sheds and artificers' shops close in the rear, an excellent smithery, timber-berths, seasoning sheds, deal and iron yard, &c., and beyond these, on the eastern extremity of the yard, the officers' houses and gardens. The superintendent's house is situated nearly in the centre of the yard. The lower or north-eastern part of the old yard is occupied by mast-ponds, mast-houses and slips, store-boat houses and slips, ballast wharf, timber-berths, and saw-pits.

Before the construction of the extension works in 1867-73, there was no wet dock or basin in Chatham-yard; but the

Medway, flowing along it in a fine sheet of water, in some degree answered the purpose of one. Owing to the shallowness of the water and the crooked navigation from Chatham round Upnor Point, ships were obliged to take in their water and ballast at one place, their stores and provisions at another, their guns, powder, and ammunition at a third in consequence of which, a ship was usually longer in getting out to sea from Chatham than even from Deptford.

The necessity of improving the accommodation at Chatham forced itself upon the attention of those who were responsible for the navy many years before the opportunity came for effecting the improvements. Pepys records a visit to Chatham in July 1663, to inspect the site of a projected wet dock. It was estimated to cost £10,000, and Pepys remarked that "the place indeed is likely to be a very fit place when the king hath money to do it with." In effect, however, it was not taken in hand by the king, who allowed the Dutch, instead of docks, to be found in the Medway. It was not till 1867 that ground was broken for the extension works at Chatham, though the plans had been prepared and certain preparations made many months before, under the supervision of Colonel Sir Andrew Clarke, C.B. The extension works may be thus described. Three basins give access from Gillingham Reach, which formerly connected the mainland with the salt marshes. These marshes were covered with water every spring tide. The Government bought 150 acres of them, and proceeded to re-make the ground which forms the site of the new dockyard workshops and factories. The three basins communicate with each other by caissons, so that ships of the largest class can pass from the bend of the Medway at Gillingham to that at Upnor. Upnor Reach entrance, opposite Upnor Castle, is 80 feet wide, the others are 84 feet. The first (Upnor) basin is the repairing basin, which has an area of 22 acres, and a depth, in common with the others, of 33 feet at spring, and 30 feet at neap tides. On the south side of this basin, and opening into it, are four graving docks, each capable of receiving the largest man of war. From this basin a passage about 175 feet long leads to the "factory" basin, which has an area of 20 acres. Contiguous to it are being erected the engine and boiler factories, and the principal workshops necessary for iron war-ship building. Next to the "factory" basin is the fitting-out basin, with an area of 28 acres. In this place ships are to receive their sea stores and be got ready for service. Here, too, they will be dismantled and paid out of commission.

Very great engineering difficulties had to be contended against in prosecuting these works, owing chiefly to the soft mud and to the treacherous character of the ground on which foundations had to be laid. Convict labour was largely employed in the work of excavation, and in the manufacture of bricks, whereof 20,000,000 a year were turned out, at small cost, on the spot. The cost of these new works is reckoned at about £2,000,000.

A considerable piece of new ground (about 2000 feet in length by 200 in breadth) was added a few years ago to the upper part of the present Chatham dockyard, on which Mr Brunel erected one of the completest saw-mills in the United Kingdom. It is supposed to be equal to the power of fifty saw-pits and nearly one hundred sawyers, and is capable of supplying the dockyards of Chatham and Sheerness with all the straight-sawn timber that they can require. But the great advantage of the plan is in its application of the steam engine to the management and arrangement of timber, by which the labour and expense of a great number of horses are saved, and the obstruction and impediments to the general services of the yard avoided.

Since the introduction of iron as the material for ships hulls, Chatham has taken a more prominent place amongst dockyards. Most of the iron ships built in the royal yards have been built at Chatham and Pembroke,—the capabilities being greater at Chatham, where the "Achilles," "Monarch," "Glatton," "Rupert," "Raleigh," "Bellero-phen," "Sultan," "Alexandra," "Temeraire," and many also of the Musquito fleet of gunboats were built. At Chatham and Devonport the whole of the cordage required for the navy is manufactured; and, since 1869, the whole business of remanufacturing copper and old iron for the navy has been concentrated at Chatham.

The first division of royal marines, consisting of twenty-eight companies, is stationed at Chatham, in excellent barracks, situated near one of the extremities of the dockyard, and occupying nine acres of ground.

There was formerly a small victualling depot, situated partly in the parish of Chatham and partly in that of Rochester, from which the ships at Chatham and at Sheerness and the Nore received a supply of provisions and water. Ships now obtain their supplies from Deptford, except fresh meat and vegetables, which are obtained on local contracts on demand.

It may be found necessary to establish a fresh depot for victualling stores at Chatham when the port becomes developed as a place for fitting out and repairing as well as for building. This process of development is going on rapidly. In March 1873 the executive of the Sheerness steam reserve with their ship were removed to Chatham, and the steps necessary for transferring the principal powers and attributes of the exposed dockyard at Sheerness to the strongly defended port of Chatham will be quickly taken. The great difficulties of navigation in the Medway, combined with the successive forts and torpedo stations which stud the river, are calculated to make Chatham unassailable. As Hollingshed said of Lundy Island, there will be "no entrance but for friends." When the Chatham works shall have been finished, the question will probably be revived whether Sheerness should not, as has been often recommended, be closed; but the advantages of having even a small yard whither ships only slightly injured by sea or by the enemy can run for repair, without having to thread the reaches of the Medway up and down, are so great that it is unlikely the place will be abandoned.

In 1876 Chatham dockyard was raised to a rear-admiral's command. The number of workmen employed at Chatham yard in 1877 is 1478 established and 2022 hired men, at an aggregate cost of £220,138.

SHEERNES DOCKYARD.—This dockyard is situated on a low point of land on the island of Sheppey, of which the soil is composed of sand and mud brought from the sea on the one side, and down the Medway on the other, and has so much contracted the mouth of that river as completely to command the entrance of it. The situation, in a military point of view, is a most important one, particularly from its vicinity to the North Sea and to the anchorage at the Nore; by which anchorage, and by the works of Sheerness, the mouths of the Thames and the Medway are completely defended.

As a situation for a dock, the objections to which it was liable are now in a great measure removed. On account of the low swampy ground on which it stood, fevers and agues were at one time so prevalent that shipwrights and other artificers were literally impressed and compelled to work at Sheerness. In process of time, however, a town sprung up close to the dockyard, and with it some little improvement by drainage, embankments, and other measures. Still it continued, for a considerable time, an unhealthy and disagreeable place. As a dockyard it was totally destitute of all convenience or arrangement; and

the whole premises, mixed among wharfs and buildings belonging to the Ordnance Department, did not cover more than 15 acres. The storehouses were dispersed in various parts of this space, and in so ruinous a state, that a ship hauled up in the mud was by far the best storehouse in the whole yard. There were two small inconvenient docks for frigates or smaller vessels. It was in fact a mere port of refitment, and might be considered as an appendage to Chatham.

The very limited capacity of Sheerness, and other considerations, led to the origination of the project of a naval arsenal at Northfleet, which, from change of circumstances, and from the important improvements now carried out at Sheerness, is not likely ever again to be revived. These improvements were of sufficient magnitude to render any establishment at Northfleet wholly unnecessary, by making Sheerness a very complete dockyard. Previously to carrying into execution this important undertaking, a committee of engineers and others was appointed, whose plan was afterwards minutely examined, and with some slight improvements adopted. The first stone was laid on the 19th August 1814, and the whole work was completed at an expense not far short of one million sterling. The additions, together with some part of the premises held by the War Department, make the whole area of the dockyard of Sheerness amount to upwards of 50 acres. The wharf wall on the south side of the basin in front of the mast-houses is 100 feet, and that on the river front 60 feet, in width, lined on both sides with as complete a specimen of good and beautiful masonry of granite as any in the kingdom.

PORTSMOUTH DOCKYARD.—Portsmouth dockyard, founded by Henry VII., will always be considered as the grand naval arsenal of England, and the headquarters or general rendezvous of the British fleet. It appears at all times to have been regarded as a very important naval station, notwithstanding the rivalry of Southampton, which was the principal port in Plantagenet times. In 1225 an order was issued to the barons of the Cinque Ports to provide men for the king's galleys at Portsmouth. In 1226 the sum of £25, 14s. 4d. was paid to the masters and crews of the "king's two great ships at Portsmouth." In 1229, £40 was paid to the king's clerk for the repairs of the king's galleys and great ship at Portsmouth. King John on several occasions assembled his barons at Portsmouth for naval expeditions. He seems, moreover, to have aimed at increasing the accommodation there for ships. In May 1212 the sheriff of Southampton was commanded to cause the docks at Portsmouth to be inclosed with a strong wall, in the manner which the archdeacon of Taunton would point out, for the preservation of the king's ships and galleys. He was also to cause pent-houses to be erected for their stores and tackle. This was to be done immediately, lest the galleys or their stores should be injured in the coming winter.

In 1540, when the dockyard seems to have been regularly established, the area of the yard was comprised in 8 acres of ground, and abutted upon the harbour near what are now known as the King's Stairs. Cromwell added 2 acres in 1658; Charles II. added 8 in 1663, and 10 more in 1667. Between 1667 and 1710, 30 acres were reclaimed from harbour mud, or bought from the town, and various subsequent additions gave 90 acres as the area on which Portsmouth dockyard stood at the end of the last century. Early in Queen Victoria's reign the growth of the steam navy necessitated an enlargement of dock accommodation. In 1843 were ordered, and in 1848 were opened a fine steam basin holding 7 acres of water, and four new docks, the dockyard ground being extended to 115 acres in all. A few years more and the want of dock

room was as great as ever. Huge iron-clads, of a draught and length greater than had yet been known, required new docks and basins of special construction. The extension works at Chatham (see above) and Portsmouth were accordingly entered upon. At the present time (August 1877) great progress has been made with both sets of works, under the direction of Colonel Sir A. Clarke, C.B., R.E., and Colonel Pasley, R.E. When finished the Portsmouth new works will comprise a tidal basin, three floating basins (upon one of which four docks will abut), a large deep dock, entered from the tidal basin, two floating basin entrance locks, which may also be used as deep docks, and greatly increased wharfage and space for building storehouses and factories. The system of docks and basins will begin with the tidal basin, entered from the harbour by an opening 100 yards wide, and having a depth of 30 feet of water at low spring tides. The deep dock and the two locks at the head of this basin will carry 28 feet of water over the invert at low spring tides; the two latter will be the entrances to the repairing, rigging, and fitting-out basins, which will lead from each other in the order named. These locks will in themselves be magnificent docks, able to receive the largest iron-clad at once from the tidal basin. They will lead to the repairing basin, a vast excavation, of a parallelogram shape, which will measure 22 acres, and carry at high spring tides 35 feet of water. This depth of water will be common to the three basins; it may be made permanent by the closing of the lock gates, and one great use of the locks will be that vessels may be docked in them in any state of the tide without lowering the level of water in the inner basins, where the tide may be ponded at its highest level of 35 feet of water, if necessary. Having been raised to this level in the locks by ingress of water from the tidal basin, vessels will be able to pass inwards to the repairing and other basins without any lessening of the depth of water. The four large docks of the repairing basin will have a depth of 30 feet of water on their sills, even when filled at high neap tides. Two of them are entirely finished, and the excavation of the others is far advanced. Opposite to these docks will be the entrance to the rigging basin, an excavation of 14 acres, in a trapezoid shape. The third, or fitting-out basin, which will receive the ships when they have been repaired and rigged, will be a pentagon of 14 acres. On one side of this basin there will be a coal depot, so that vessels may leave the docks with their coals on board, ready for sea. In addition to these four basins and seven docks there is an entrance between the tidal basin of the new works and the steam basin of 1848, which will connect the old and new portions of the dockyard; and, as for wharfage, the harbour or north wall of the extension works will have 26 feet and the wall of the tidal basin 30 feet of water alongside it at low spring tides, making altogether three miles of wharfage accommodation in connection with the extension works, and that for ships of the largest class. The size of the whole dockyard will be more than doubled, for its present 115 acres will be increased by more than 177 acres of reclaimed mud land and fortifications glacis, making in all an exact measurement of 293 acres 2 roods and 29 perches. These great works were estimated when designed in 1865 to cost £3,000,000, exclusive of convict labour. They have given employment on the spot to upwards of 1600 free men and about 800 convicts. The latter are employed in brick-making, and have made upwards of 100,000,000 bricks since the works were begun.

A complete network of railway connects all parts of the yard with the docks and basins, and the whole with the neighbouring railroad to all parts of the kingdom, so that iron or coal can be put into waggon at Sheffield or Cardiff

and brought in a few hours, without change of medium, to the side of the ship which is to use the material.

This dockyard, accordingly, is by far the most capacious of all; and the safe and extensive harbour, the noble anchorage at Spithead, the central situation with respect to the English Channel and the opposite coast of France, render Portsmouth of the very first importance as a naval station; and in this view of it, every possible attention appears to have been paid to the extension and improvement of its dockyard.

In the centre of the old wharf-wall, facing the harbour, is the entrance into the great basin, whose dimensions are 380 by 260 feet, and its area $2\frac{1}{2}$ acres. Into this basin open four excellent dry docks, and on each of its sides is a dry dock opening into the harbour; and all of these six docks are capable of receiving ships of the largest class. Besides these is a double dock for frigates, the stern dock communicating through a lock with the harbour, and the head dock with another basin about 250 feet square. There is also a camber, with a wharf-wall on each side, 660 feet in length, and of sufficient width to admit of transports and merchant ships bringing stores to the dock-yard. In the same face of the yard are three building slips capable of receiving the largest ships, and a small one for sloops, besides two building slips for frigates on the northern face of the yard, and a smaller slip for sloops. The range of storehouses on the north-east side, and the rigging-house and sail-loft on the south-west side of the camber are magnificent buildings, the former occupying nearly 600 feet in length, exclusive of the two intermediate spaces, and nearly 60 feet in width, and the two latter 400 feet. The sea-store houses occupy a line of building which, with the three narrow openings between them of 25 feet each, extend 800 feet. The rope-house, tarring-house, and other appendages of the ropery are on the same scale; but since the suppression of the Portsmouth ropery (in 1869), and the concentration of rope-making at Devonport and Chatham, these premises have been used as general storehouses. The two sets of quadrangular storehouses, and the two corresponding buildings, with the intervening timber-berths and saw-pits, at the head of the dry docks, issuing from the great basin, are all excellent, and conveniently placed. The smithery is on a large scale, and contiguous to it are the various factories for metal work used in the building and repair of iron ships. Formerly there was also a copper mill, capable of turning out 300,000 sheets a year, besides bolts, bars, and gudgeons for ships' use. But since 1869 the whole business of remaking old metal of whatever kind has been concentrated at Chatham. Most of these factories were constructed under the direction of General Benthams. At the head of the north dock are the wood mills, at which every article of turnery, rabetting, &c., is performed for the use of the navy, from boring the chamber of a pump to the turning of a button for a chest of drawers. But the principal part of these mills is the remarkable machinery for making blocks, contrived by Brunel (see BLOCK-MACHINERY).

The northern extremity of the dock-yard is chiefly occupied with seasoning-sheds, saw-pits, and timber-berths, the working boat-house, and boat store-house. On the eastern extremity are situated the houses and gardens of the superintendent and principal officers of the yard, the chapel, and the late royal naval college.

Portsmouth yard, in 1877, employs 4910 men, at a cost of £324,844.

Naval College.—The establishment of a college at Portsmouth for the education of young gentlemen for the navy was first formed in 1729 under the title of the Naval Academy. It contained 40 scholars, the sons of the nobility and gentry. In 1806 it was reorganized under the name of the Royal Naval College, and the number of

scholars was raised from 40 to 70, of whom 40 were to consist of the sons of commissioned officers of the navy, and to receive their board, clothing, lodging, and education free of all expense; the remainder to consist of sons of noblemen, gentlemen, civil and military officers, on payment of £72 a year. The age of admission was from twelve and a half to fourteen years. No student to remain at college longer than three years; at the end of which time, or sooner if he should have completed the plan of education, he was to be discharged into one of Her Majesty's ships, the college time being reckoned two years of the six required to be served to qualify for such a commission. In 1837 the Royal Naval College for the education of young gentlemen for the navy was abolished, and by an order in council of 1838 it was reopened as an establishment for the scientific education of a certain number of officers and mates of the naval service, the latter to have passed both their examinations in seamanship and in navigation, and to remain one year in the college. A limited number of commissioned officers of any rank were also permitted to study at the college, but no expense was incurred on their account.¹

Naval Architectural School.—The number of students formerly did not exceed 24. Candidates were admitted by examination at stated periods; the age of entrance was from fifteen to seventeen, and the duration of apprenticeship seven years. At the expiration of their apprenticeship they were eligible to all the situations in the ship-building department of her Majesty's dockyards, to be there employed as supernumeraries until regular vacancies might occur. This school, which was subsequently embodied with South Kensington, is now incorporated with Greenwich College.

Victualling Yard.—There were formerly two victualling establishments at this port,—the one in Portsmouth town, the other across the harbour, at a place called Weevil,—both of them inconveniently situated for supplying the ships with water and provisions, more especially such as had to take them on board at Spithead. The former consisted chiefly of provision-stores and magazines, with a tide-mill and a bakery; at the latter there were a cooperage and a brewery. The victualling establishments are now consolidated at Gosport, and the Royal Clarence Victualling

¹ On 1st February 1873 Portsmouth College was superseded by the Royal Naval College at Greenwich. The means of education provided at Portsmouth were at once too limited and not technical enough. The disused buildings of Greenwich hospital furnished the extra space required, and the new system of higher education of naval officers, which was pronounced by the select committee on that subject to be necessary, was considered and carried out by Mr Goschen, then first lord of the Admiralty. Rear-admiral Sir Cooper Key, K.C.B., was the first president of the college. The minute of the Board of Admiralty consequent upon the Order in Council of 16th January 1873, whereby Greenwich College was founded, states that—"My Lords intend that the Royal Naval College at Greenwich shall be so organized as to provide for the education of naval officers of all ranks above that of midshipman, in all branches of theoretical and scientific study bearing upon their profession; but my Lords will continue the instruction given in the 'Excellent' gunnery ship as heretofore, and arrangements for instruction in practical surveying will also be continued at Portsmouth. My Lords desire, by the establishment of the college, to give to the executive officers of the navy generally every possible advantage in respect of scientific education; but no arrangements will be made at all prejudicing the all-important practical training in the active duties of their profession." All matters relating to the particular classes of officers admitted to study, and the different subjects of study, are determined by such regulations as may from time to time be laid down by the Admiralty. Special pecuniary concessions are made to officers on half-pay who may enter for study, and officers of the lower grades are put upon full pay, while in all cases there is a Government contribution in aid of the mess. Special professional inducements to study are offered, and everything is done to make the college answer thoroughly the purposes for which it was founded. Practical knowledge is taught on the Thames and its estuaries, as theory is taught in the college.

Yard is a very fine establishment. At this victualling yard, as at Deptford and Plymouth, large quantities of biscuit and flour are manufactured. Casks and barricoes are also made; but with these exceptions there is no manufacture at Gosport. The depôt is supplied with sea provisions and clothing from Deptford, and re-issues them to the fleet at Portsmouth. There is an excellent slaughter yard in the place, where cattle delivered under contract are slain, and the meat issued to the fleet.

Haslar Hospital.—This magnificent hospital for the reception of sick and wounded lies at the point seawards, on the Gosport side of the harbour. It is in charge of a resident medical inspector-general, who is assisted by a competent medical and clinical staff.

The second division of royal marines, consisting of twenty-six companies, is stationed at Forton barracks, on the Gosport side. Sixteen companies of royal marine artillery have excellent quarters at Eastney, three miles from Portsmouth, opposite St Helen's, and at Fort Cumberland, a half mile from Eastney.

PLYMOUTH DOCKYARD.—The naval station of Plymouth is hardly inferior to that of Portsmouth. It possesses one of the finest harbours in the world, capable of containing, in perfect security at their moorings, not less than a hundred sail of the line; and by means of the breakwater it may boast of an excellent roadstead for eighteen or twenty sail of the line. The old dockyard has only one basin, without gates, but the dimensions are 300 by 280 feet. The excellent harbour of Hamoaze, on the western bank of which the wharf-wall extends, almost compensates for the want of other basins, especially as the depth of water allows the largest ships to range along the jetties, and receive their stores on board immediately from the wharf.

Plymouth dockyard proper extends in a circular sweep along the shores of Hamoaze 3500 feet, its width about the middle, where it is greatest, being 1600, and at each extremity 1000 feet, making its superficial contents about 96 acres. The land front is about 2850 feet. In the line facing the harbour are two dry docks for ships of the first rate, a double dock for seventy-four gun ships, communicating with Hamoaze, and another dock for ships of the line, opening into the basin. There is, besides, a graving-dock without gates, and a canal or camber similar to that in Portsmouth yard, for the admission of vessels bringing stores into the yard, which, communicating with the boat-pond, cuts the dock-yard nearly into two parts. There are five jetties projecting from the entrances of the dry docks into Hamoaze, alongside of which ships are conveniently brought when undocked. All these are situated between the centre and the northern extremity of the harbour line. On the southern part are three building slips for the largest class of ships and two for smaller vessels, the outer mast-pond and mast-houses, timber-berths, saw-pits, and smithery. Higher up, on this end of the yard is an extensive mast-pond and mast-locks, with plank-houses over them, and, above these, three hemp magazines, contiguous to which is the finest ropery in the kingdom, consisting of two ranges of buildings, one the laying-house, the other the spinning-house, each being 1200 feet in length, and three stories in height. In the construction of the new rope-house no wood has been used excepting the shingles of the roof, to which the slates are fastened. All the rest is of iron. The ribs and girders of the floors are of cast iron, covered over with Yorkshire paving stone, and the doors, window frames, and staircases are all of cast iron, so that the whole building may be considered as proof against fire.

The northern half of the yard, besides the docks and basin, with all the appropriate working sheds and artificers'

shops, contains a cluster of very elegant stone buildings, ranged round a quadrangle, the longest sides being about 450 feet, and the shortest 300 feet. Within the quadrangle are also two new ranges of buildings, in which iron has been used in the place of wood. These buildings consist of magazines for different kinds of stores, rigging-houses, and sail-lofts. The northern and upper part of the yard is occupied by a range of handsome houses, with good gardens behind them, for the admiral-superintendent and the principal officers of the yard, the chapel, the guard-house, and pay-office, stables for the officers and the teams, and a fine reservoir of fresh water for the supply of the yard.

Plymouth is not only a good building and repairing yard, on account of its excellent docks and slips, and the great length of line along the Hamoaze, but also a good refitting yard.

A large addition has been made to Plymouth yard by the fine establishment of Keyham steam factory which adjoins it, with a water frontage of about 1300 feet, with two steam basins—one 630 feet by 560 feet, and another 700 feet by 400 feet. There are also excellent graving docks leading into these basins, around which are coal sheds, storehouses, boat berths, engineers' shops, boiler factories, and all the necessary appliances of mast shears, cranes, and capstans worked by hydraulic or steam machinery. There is no railway within the yard connecting it with the general system of railroad, though means are being taken to secure a junction with the narrow gauge line through Okehampton. Traction engines, called "camels," at present discharge most of the work of a railway.

The number of men borne in Plymouth yard in 1877 is 4336, costing £292,563.

Plymouth Victualling Establishment.—The Royal William Victualling Yard stands on the eastern entrance to Hamoaze, on about 11 acres of ground,—adjoining 4 acres on its south side, on which stand two small forts, and a reservoir containing about 8000 tons of water, which supplies the fleet—the water being brought from Dartmoor.

Plymouth Hospital is a handsome building of stone, or rather a series of separate buildings, regularly arranged, in which respect, as admitting a freer circulation of air, it is perhaps superior to that of Haslar.

The third division of royal marines, consisting of thirty companies, is stationed at Plymouth. The barracks, situated at Stonehouse, are very airy and spacious.

PEMBROKE DOCKYARD.—This dockyard was established in 1814, and is now used merely as a building-yard. It is situated on the southern shore of Milford Haven, not two miles from the town of Pembroke. It includes an area of about 60 acres, its surface descending in a gradual slope to the water's edge, along the shore of which there is a frontage of about 2350 feet. It has a dock, and 14 building slips, 6 of which are for first-rates. The largest wooden ship of the royal navy, the "Duke of Wellington," 131 guns, was launched from this yard. Here, too, were built the "Thunderer" and the "Fury," the huge mastless iron-clads, intended with the "Devastation" and the "Staunches" to form the sea police of the coasts.

OTHER YARDS.—In addition to the foregoing, there are several small naval yards—at Haulbowline in the Cove of Cork, at Gibraltar, Malta, Antigua, Halifax, Bermuda, Kingston (Jamaica), Cape of Good Hope, Trincomalee, and Hong Kong.

DOCKYARD OFFICERS.—The management of the dockyards is intrusted to a superintendent, either a rear-admiral or captain; a master attendant and his assistant; a chief constructor and assistant; a store-keeper; an accountant, who is also store-receiver; and a director of police.