Chapter One.

Treats of Ships in General.

There is, perhaps, no contrivance in the wide world more wonderful than a ship—a full-rigged, well-manned, gigantic ship!

Those who regard familiar objects in art and nature as mere matters of course, and do not trouble themselves to wander out of the beaten track of everyday thought, may not at first feel the force or admit the truth of this statement. Let such folk endeavour to shake themselves vigorously out of this beaten track of everyday thought. Let them knit their brows and clench their teeth, and gaze steadfastly into the fire, or up at the sky, and try to realise what is involved in the idea of—a ship.

What would the men of old have said, if you had told them that you intended to take yonder large wooden house, launch it upon the sea, and proceed in it out of sight of land for a few days? "Poor fellow," they would have replied, "you are mad!" Ah! many a wise philosopher has been deemed mad, not only by men of old, but by men of modern days. This "mad" idea has long since been fulfilled; for what is a ship but a wooden house made to float upon the sea, and sail with its inmates hither and thither, at the will of the guiding spirit, over a trackless unstable ocean for months together? It is a self-sustaining movable hotel upon the sea. It is an oasis in the desert of waters, so skilfully contrived as to be capable of advancing against wind

and tide, and of outliving the wildest storms—the bitterest fury of winds and waves. It is the residence of a community, whose country for the time being is the ocean; or, as in the case of the *Great Eastern* steamship, it is a *town* with some thousands of inhabitants launched upon the deep.

Ships are, as it were, the electric sparks of the world, by means of which the superabundance of different countries is carried forth to fill, reciprocally, the voids in each. They are not only the media of intercourse between the various families of the human race, whereby our shores are enriched with the produce of other lands, but they are the bearers of inestimable treasures of knowledge from clime to clime, and of gospel light to the uttermost ends of the earth.

But for ships, we should never have heard of the wonders of the coral isles and the beauties of the golden South, or the phenomena and tempests of the icy North. But for ships, the stirring adventures and perils of Magellan, Drake, Cook, etcetera, had never been encountered; and even the far-famed Robinson Crusoe himself had never gladdened, and saddened, and romantically maddened the heart of youth with his escapes, his fights, his parrots, and his philosophy, as he now does, and as he will continue to do till the end of time.

Some account, then, of ships and boats, with anecdotes illustrative of the perils to which they are frequently exposed, cannot fail, we think, to prove interesting to all, especially to boys, for whose particular edification we now write. Boys, of all creatures in this world, are passionately fond of boats and ships; they make them of every shape and size, with every sort of tool, and hack and cut their fingers in the operation, as we know from early personal experience. They sail them, and wet their garments in so doing, to the well-known sorrow of all right-minded mammas.

They lose them, too, and break their hearts, almost, at the calamity. They make little ones when they are little, and big ones when they grow big; and when they grow bigger they not unfrequently forsake the toy for the reality, embark in some noble craft, and wed the stormy sea.

A word in your ear, reader, at this point. Do not think that because you fall in love with a *ship* you will naturally and necessarily fall in love with the *sea*! Some do, and some don't: with those who do, it is well; with those who don't, and yet go to sea, it is remarkably ill. Think *philosophically* about "going to sea," my lads. Try honestly to resist your own inclination *as long as possible*, and only go if you find that *you can't help it*! In such a case you will probably find that you are cut out for it—not otherwise. We love the sea with a true and deep affection, and often have we tossed upon her foam-topped waves; but we don't wish to be a sailor—by no manner of means!

And now, boys, come along, and we will conduct you as pleasantly and profitably as we can from a ship's cradle, through all her stormy existence, to her grave.

Chapter Two.

The Earliest Days of Water-Travelling.

Once upon a time there were no ships. Men did not know the meaning of the word; they did not want them; and, for many, many centuries the sea-gulls had the ocean all to themselves. But *boats* are of very ancient date. Doubtless the *first* boats must have been constructed by the *first* men who dwelt on the earth. They consisted,

probably—for we are now in the land of conjecture—of stumps of fallen trees, or bundles of rushes, seated astride of which the immediate descendants of our first parents ferried themselves over small lakes and across rivers.

Wet feet are not agreeable under any circumstances. We can conceive that prolonged voyages performed in this fashion—say several hundred yards or a mile—rendered those primitive mariners so uncomfortable, that they resolved to improve their condition; and, after much earnest thought, hit upon the plan of fastening several logs together by means of twigs, and thus they formed *rafts*.

As time progressed, and men began to display wisdom in making tools of stone and in the moulding of metal, we can imagine that they soon bethought

AN ANCIENT MARINER.

themselves of flattening the surface of their rafts; and then, finding them unwieldy and difficult to manage, no doubt, they hit upon the idea of hollowing out the logs. Adzes were probably not

invented at that time, so they betook themselves to the element of fire—which is at the present day used by savage nations for the same purpose—and burned out the insides of their logs. Thus *canoes* sprang into being.

But such canoes were clumsy and heavy, besides being liable to split; men therefore bethought themselves of constructing a light framework of wood, which they covered with bark or skin. Then artificers in iron invented saws; logs were ripped up; planks were formed; pitch oozed ready to hand from the trees; with grass, perchance, they caulked the seams;—and soon the first *boat* floated on the water—clumsy and tub-like, no doubt, but serviceable withal—and youths of a hundred years old, and full-grown men of two or three hundred, capered and shouted on the shore with delight at the great invention; while venerable patriarchs, of seven or eight hundred summers, gazed in wonder, with almost prophetic solemnity, and exclaimed that they had never before seen the like of *that* in all the course of their long, long lives!

Those times are old now—so old that men can scarcely get their minds to realise how old they are; nevertheless, the craft that were used then are used even now, and that not only among the savages of distant lands, but by men living at our very doors.

The *coracle*, a basket-boat of the most primitive description, is still occasionally met with in South Wales. It is neither more nor less than a large wicker basket covered with a hide, and is tub-shaped, and clumsy to a degree. When the Romans invaded Britain, this species of boat was in common use.

THE CORACLE.

Like the canoe of the North American Indian, it is easily upset, and we should think must be rather unmanageable; but as we are not likely ever again to be reduced to it in this country, we can afford to regard its faults with indifference.

From little boats to big boats there is but a step; and no doubt rivers were soon navigated, and new countries explored, while those who lived near the sea-coast dared even to launch their boats upon the ocean; but they "hugged the shore," undoubtedly, and seldom ventured to proceed at night unless the stars shone brightly in the sky.

Years rolled on, and dwellers on the sea-coast became more and more venturous

in their voyages along the shore. It behoved them to have larger boats, or barges, with numerous rowers, who would naturally carry weapons with them to guard themselves from foes. War-galleys sprang into being. Strong winds sometimes carried these off-shore, and out of sight of land. Ah, reader! who can conceive the feelings of the first mariners who saw the solid land sink on the horizon, and beheld nothing substantial in all the waste of waters, save their own tiny bark that reeled beneath them on the heaving billows? Perchance these first adventurers on the deep found their way back to land, and afterwards tried the bold experiment of steering by the stars. Perhaps not; but at length it did come about that ships were built, and men were found bold enough to put to sea in them for days and weeks together.

The ark is the first ship of which we have any authentic account. We now leave the region of conjecture; for the ark was built by Noah under the immediate direction of the Almighty, and we have a minute account of it in the Bible.

More than two thousand three hundred years before our Lord and Saviour Jesus Christ came to earth, man's wickedness had attained to such a height that God resolved to destroy the inhabitants of the world by a deluge. But, in the midst of wrath, God remembered mercy. He spared Noah and his family, and saved them from destruction by placing them in the ark along with pairs of the lower animals.

Every reader of the Bible knows the story of the deluge; but everyone may not be aware that traditions of this deluge are found in every part of the earth. East, west, north, and south—civilised and savage—all men tell us of a great flood which once covered the world, and from which only one family was saved, in a boat, or a canoe, or an ark.

What the barbarous and savage nations know dimly from tradition, we know certainly and fully from the inspired Word of God. The ark was built; the flood came; Noah with his family and two of every living creature entered into it; and for months the first ship floated on a sea whose shoreless waves flowed round and round the world.

What the ark's form was we cannot precisely tell; but we know its dimensions pretty accurately.

Although it was not intended for voyaging, the ark must necessarily have been a perfect model of a vessel, meant to float upon the waters. To some extent, too, it must have been fitted to ride upon turbulent billows; for it "went upon the face of the waters" for upwards of seven months, and before it rested finally on the top of Mount Ararat, "God made a wind to pass over the earth, and the waters assuaged." In regard to its size, the most interesting way to consider it, perhaps, will be to compare it with the *Great Eastern*, the largest ship that has yet been built by man. Assuming a cubit to be about 18 inches, the length of the ark was about 450 feet, its breadth about 75 feet, and its depth about 45 feet.

The *Great Eastern's* length is 680 feet, its breadth 83 feet, and its depth from deck to keel 60 feet.

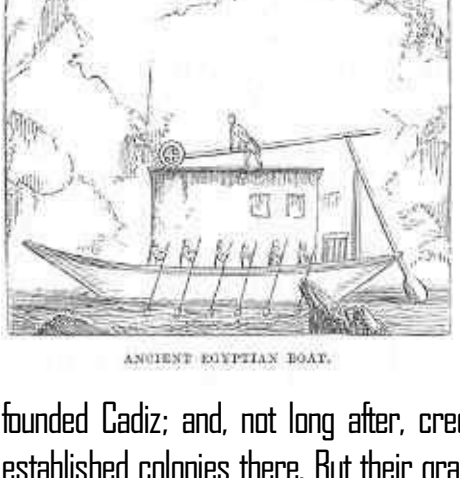
The ark was built of gopher-wood, which is thought by some to be pine, by others cedar. It consisted of three stories, and had a window and a door, and was pitched within and without. But it had neither masts nor rudder; and it is evident that, although it was man's refuge, the ark was not designed to be managed by man, for after Noah and his family had entered in, God took on himself the guidance and

preservation of their vessel. Thus our Saviour—of whom the ark was a type—specially guides and protects those who flee to him for refuge.

But although we have noticed the ark as being the first ship, we cannot with propriety place it in the front of the history of navigation. After the flood the ark seems to have been soon forgotten, or at least imperfectly remembered, and men reverted to their little canoes and clumsy boats, which sufficed for all their limited wants. It was not until about a thousand years later in the world's history that men built ships of considerable size, and ventured on prolonged *coasting*-voyages, for the purposes of discovery and commerce. Navigation had been practised, and the art of ship-building had made very considerable progress, long before men dared to lose sight of the shore and venture out upon the mysterious bosom of the great unknown sea.

To the ancients the Mediterranean was the ocean; and among its bays, and creeks, and islands, maritime enterprise sprang into being and rose into celebrity. Among the Phoenicians, the Egyptians, and Hebrews, we find the earliest traces of navigation and commerce. The first of these nations, occupying the narrow slip of land between Mount Lebanon and the Mediterranean, rose into fame as mariners between the years 1700 and 1100 before Christ—the renowned city of Sidon being their great sea-port, whence their ships put forth to trade with Cyprus and Rhodes, Greece, Sardinia, Sicily, Gaul, and Spain. Little is known of the state of trade in those days, or of the form or size of ancient vessels. Homer tells us, in his account of the Trojan War, that the Phoenicians supplied the combatants with many articles of luxury; and from Scripture we learn that the same enterprising navigators brought gold to Solomon from Ophir in the year 1000 B.C.

A short time previous to this the Phoenicians ventured to pass through the Strait of Gibraltar, and for the first time beheld the great Atlantic Ocean.



ANCIENT EGYPTIAN BOAT.

Proceeding along the coast of Spain, they founded Cadiz; and, not long after, creeping down the western coast of Africa, established colonies there. But their grandest feat was achieved about 600 years B.C., when they sailed down the Red Sea and the eastern coast of Africa, doubled the Cape of Good Hope, sailed up the western coast, and returned home by the Strait of Gibraltar. Bartholomew Diaz must hide his diminished head before this fact; for, although he gets all the credit, the Phoenicians of old "doubled the Cape" at least twenty centuries before him!

That long voyages were made by the men of old, before authentic history began, seems highly probable. The expedition of the *Argonauts* to Colchis in the year 1250 B.C., in search of the "Golden Fleece," is the first ancient voyage that lays claim to authenticity. What the Golden Fleece was is uncertain; some think it was a term used to symbolise the mines of precious metals near the Black Sea. Whatever it was, the *Argonauts* went in search of it: whether or not they found it is unrecorded in history. Jason, son of the King of Thessaly, was the leader of this expedition, which consisted of one ship and fifty men. A man named *Argus* built the ship, which

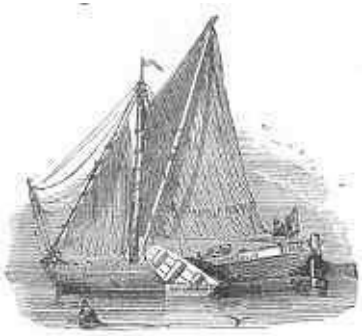
from him was named the Argo, hence the name of *Argonauts*.

In treating of ancient vessels, we may as well proceed on the principle suggested by a sagacious child, who, when his mother was about to tell him a story, usually begged of her to "bedin at the bedinning." We shall begin at the beginning.

Chapter Three.

Rafts and Canoes.

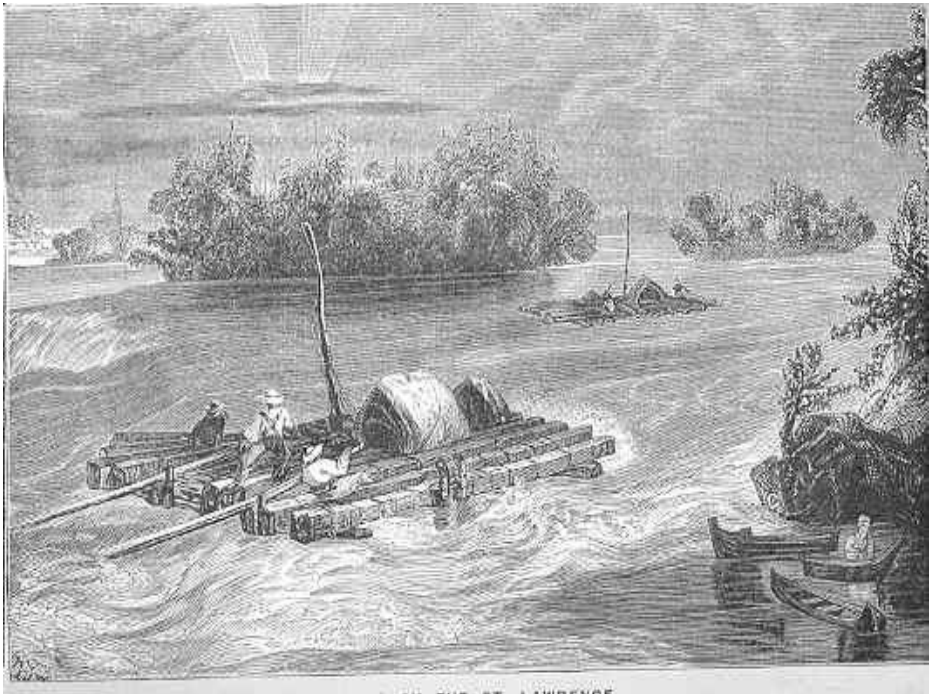
Rafts, as we have already remarked, must undoubtedly have been the beginning of navigation. But they have not, like many other species of ancient craft, been altogether superseded by modern inventions. True, we do not nowadays carry on war on rafts, but we still carry on trade with them in many parts of the world. How the rafts of ancient times were formed we cannot tell precisely, though we can easily guess; but one thing we know, and that is, that the first improvement made in such craft was the thrusting of a few thick planks down into the water, to the depth of three or four feet, between the logs which composed the raft. These acted the part of a keel, and, by pressing against the water *side-ways* when a *side* wind blew, prevented the raft from making much of what is called *leeway*—that is, drifting in the direction in which the wind happened to be blowing. Some sorts of Dutch vessels use lee-boards for this purpose at the present time.



DUTCH BOAT WITH LEE-BOARD.

The rafts now in use on the great rivers of America are exceedingly curious in many respects. One peculiarity of many of them is that they float *themselves*, not goods, to market—the pine logs of which they are constructed being the marketable commodity. Some of these "lumber-rafts," as they are called, are of great size; and as their navigators have often to spend many weeks on them, slowly floating down the rivers, they build huts or little cottages on them, cook their provisions on board, and, in short, spend night and day in their temporary floating-homes as comfortably as if they were on the land.

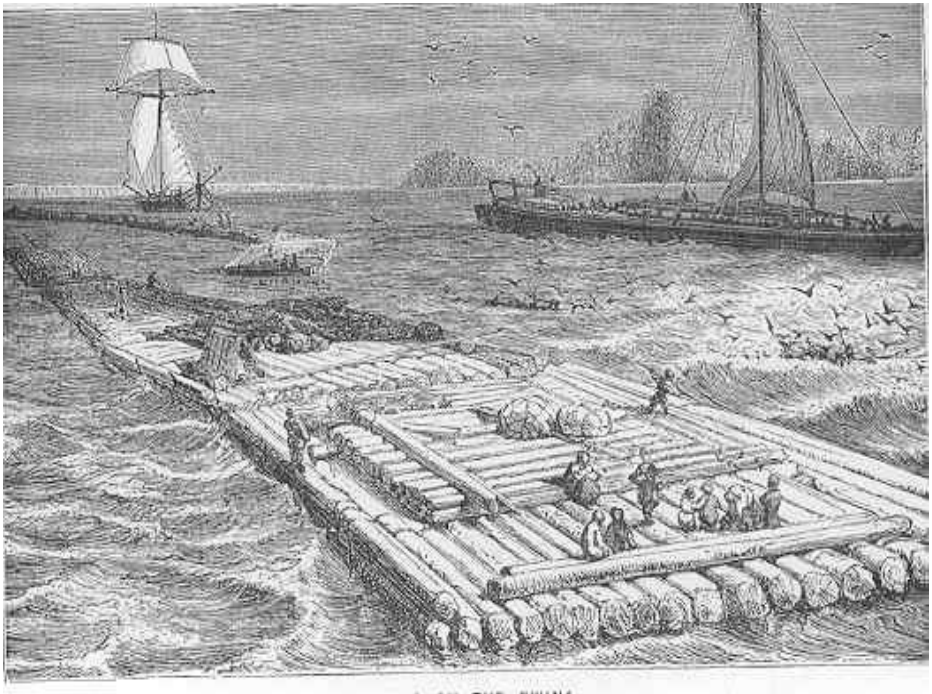
When these rafts approach a waterfall or a rapid, they unfasten the lashings and allow several logs tied together to run down at a time. After the rapid is passed, the loose logs are collected together, the raft is reconstructed, and the voyage down to the sea continued. Of course, huts are built only on rafts which navigate the largest rivers, and are not thus liable to be taken to pieces.



RAFTS ON THE ST. LAWRENCE. *Page 37.*

When the logs reach the sea, they are shipped to various parts of the world where timber is scarce. Large quantities are imported into Great Britain from Canada and other parts of America.

A bold thing has occasionally been done. Instead of shipping the logs in vessels, enterprising and ingenious men built them into a *solid ship*, leaving a small space to serve as a cabin and a hold for provisions; then, erecting masts, they hoisted sail, and in this singular craft crossed the Atlantic. On arriving at port they broke up their raft-ship and sold it.



RAFTS ON THE DWINA. Page 26

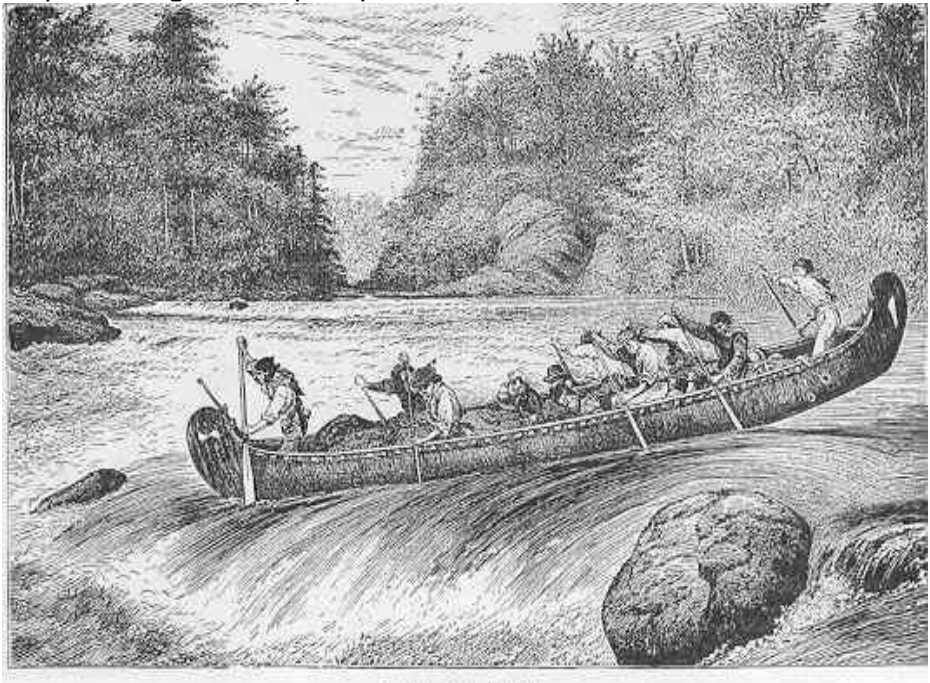
The immense size of the rafts which are floated down some of the great rivers of the world may be gathered from the following engraving, which represents a raft on the Dwina, one of the great rivers of Russia.

Rafts, however, have not been confined to the purposes of traffic. They have frequently been the means of saving the lives of shipwrecked mariners; but too often they have been the means only of prolonging the wretched existence of those who have ultimately perished at sea.

Turning now from the consideration of rafts, we shall describe canoes.

Canoes must, we think, have been invented after rafts. They were formed, as we have said, out of logs, of bark and of skins stretched upon frames of wood. Of ancient canoes we can say little. But it is probable that they were similar in most respects to the canoes used by savage nations at the present time; for man, in his lowest or most savage condition, is necessarily the same now that he was in ancient times. We shall, therefore, take a glance at the canoes of savage nations now existing, and thus shall form a good idea, we doubt not, of what canoes were in days of old.

Simplest among them all, perhaps, are the canoes of the North American Indians.



CANADIAN CANOE. Page 31.

These are built of thin laths and ribs of wood, and are covered with the bark of the birch-tree. The sheets of bark are not a quarter of an inch thick. Several sheets

are used in the covering of one canoe. They are sewed together with the long pliant roots of the pine, and the seams are rendered tight with gum procured from the same tree. So light are these canoes, that two men can carry on their shoulders one capable of holding eight or ten men, with their provisions, etcetera, for a voyage of many months. They are of various sizes—from the hunting canoe which holds one Indian, to the largest canoe that carries fourteen. They are propelled by short paddles instead of oars.

Many and terrible are the risks run by *voyageurs* who travel through the lakes and rivers of North America in these canoes.

The following anecdote is related of a narrow escape made by some fur-traders while descending one of the rivers in the backwoods of the Hudson Bay Territory:—One fine evening in autumn, a north-canoe was gliding swiftly down one of the noble bends in the river referred to. New, beautiful, and ever-changing scenes were being constantly opened up to the view of the *voyageurs*, whose plaintive and beautiful canoe-songs were rolling over the waters. Suddenly the song ceased as the distant roar of a waterfall struck their ears, and the steersmen—for there are usually two, one in the bow and one in the stern—prepared to land and "*make a portage*,"—that is, carry the canoe and lading past the falls by land, and re-launch and re-load in the smooth water below.

The approach to the landing-place at the head of the fall was somewhat difficult, owing to a point of rock which projected into the stream in the direction of the fall, and round which point it was necessary to steer with some dexterity, in order to avoid being drawn into the strong current. The fearless guides, however, had often passed the place in former years in safety, and accordingly dashed at the point

with reckless indifference, their paddles flinging a circle of spray over their heads as they changed from side to side with graceful but vigorous rapidity. The swift stream carried them quickly round the point of danger, and they had almost reached the quiet eddy near the landing-place when the stem of the canoe was caught by the current, which instantly whirled it out from the shore and carried it down stream like an arrow. Another moment, and the gushing water dragged them to the verge of the fall, which thundered and foamed among frightful chasms and rocks many feet below. It was the work of a moment. The stern of the canoe almost overhung the abyss, and the voyageurs plied their paddles with the desperation of men who felt that their lives depended on the exertions of the next awful minute. For a few seconds the canoe remained stationary, and seemed to tremble on the brink of destruction—the strength of the water and the power of the men being almost equally balanced—then, inch by inch, it began slowly to ascend the stream. The danger was past! A few nervous strokes, and the canoe shot out of the current like an arrow, and floated in safety in the still water below the point.

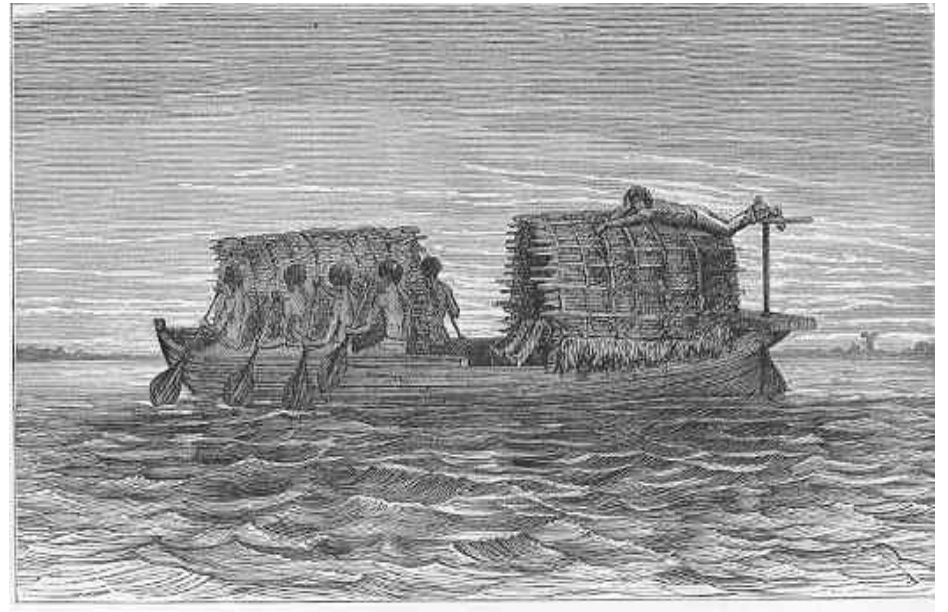
The whole thing, from beginning to end, occurred in a few seconds; but who can describe or comprehend the tumultuous gush of feeling aroused during those brief moments in the bosoms of the *voyageurs*? The sudden, electric change from tranquil safety to the verge of what appeared certain destruction—and then, deliverance! It was one of those thrilling incidents which frequently occur to those who thread the wildernesses of this world, and is little thought of by them beyond the moment of danger; yet it was one of those solemn seasons, more or less numerous in the history of all men, when the Almighty speaks to his careless creatures in a voice that cannot be mistaken, however much it may be slighted; awakening them, with a rough grasp, to behold the slender cord that suspends

them over the abyss of eternity.

The canoes used by the Eskimos who inhabit the Polar Regions are made of a light framework of wood, which is covered entirely over with seal-skin—a round hole being left in the centre, in which the Eskimo sits. Round this hole there is a loose piece of skin, which is drawn up by the man and fastened round his waist. The machine is thus completely water-tight. No waves can dash into, although they can sweep over it; and if by chance it should upset, the Eskimo can turn it and himself up into the proper position by one dexterous sweep of his long, double-bladed paddle. The paddle, which varies from ten to fifteen feet, is simply a pole with a blade at each end. It is grasped in the centre, and each end dipped alternately on either side of the *kayak*, as this canoe is called. Eskimo kayaks are first-rate sea-boats. They can face almost any sort of weather. They are extremely light, and are propelled by the natives very swiftly. In these frail canoes the natives of the Polar Regions pursue seals and whales, and even venture to attack the walrus in his native element. The kayak is used exclusively by the men. The oomiak, or women's canoe, is of much larger and clumsier construction, somewhat like a boat. It is open above, and can hold a large family of women and children. Like the kayak, it is a framework of wood covered with seal-skin, and is propelled by means of short paddles of the spoon form.

ESKIMO KAYAK.

The famous "Rob Roy" canoe, which is now so much in vogue among boys and young men of aquatic tendency, is constructed and managed on precisely the same principles with the Eskimo kayak; the only difference between the two being that the "Rob Roy" canoe is made of thin wood instead of skin, and is altogether a more elegant vessel. An account of it will be found in our chapter on "Boats." The South Sea islanders also use a canoe which they propel with a double-bladed paddle similar to that of the Eskimos. They are wonderfully expert and fearless in the management of this canoe, as may be seen from the annexed woodcut.



BOAT IN USE ON THE AMAZON. *Page 41.*

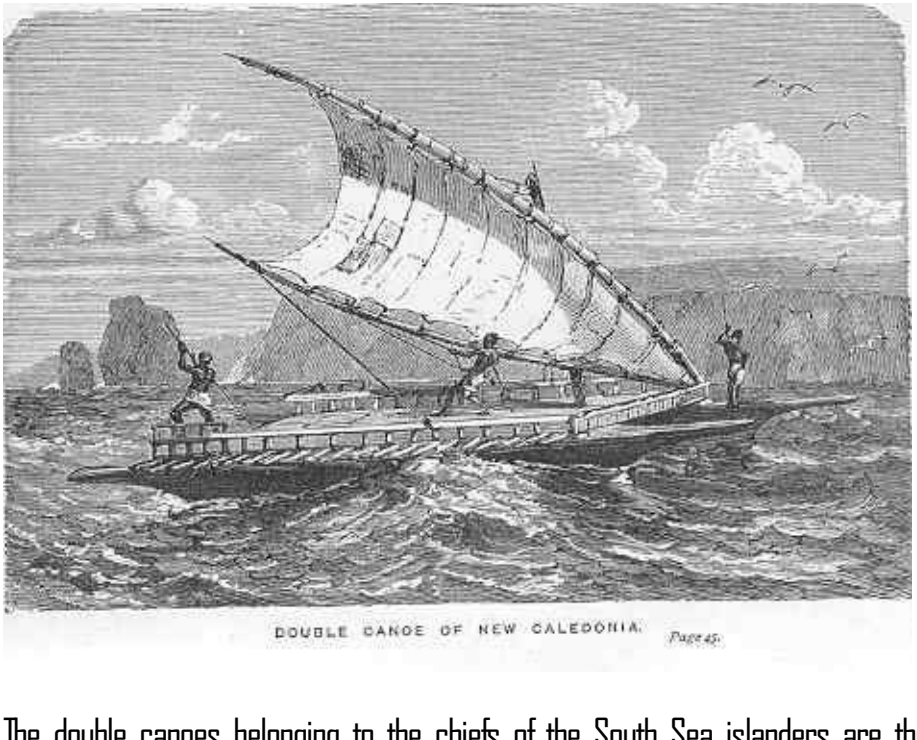
In order to show that the paddle of the canoe is more natural to man than the oar, we present a picture of the canoe used by the Indians of the Amazon in South America. Here we see thar the savages of the south, like their brethren of the north, sit with their faces to the bow and urge their bark forward by neans of short paddles, without using the gunwale as a fulcrum. The oar is decidedly a more modern and a more scientific instrument than the paddle, but the latter is better suited to some kinds of navigation than the former.

SOUTH SEA ISLANDERS IN CANOE. Page 37.

Very different indeed from the light canoes just described are the canoes of the South Sea islanders. Some are large, and some are small; some long, some short; a few elegant, a few clumsy, and one or two peculiarly remarkable. Most of them are narrow, and liable to upset; in order to prevent which catastrophe the natives

have ingeniously, though clumsily, contrived a sort of "*outrigger*," or plank, which they attach to the side of the canoe to keep it upright. They also fasten two canoes together to steady them.

One of these *double canoes* is thus described by Cheever in his "Island World of the Pacific:"—"A double canoe is composed of two single ones of the same size placed parallel to each other, three or four feet apart, and secured in their places by four or five pieces of wood, curved just in the shape of a bit-stock. These are lashed to both canoes with the strongest cinet, made of cocoa-nut fibre, so as to make the two almost as much one as same of the double ferry-boats that ply between Brooklyn and New York. A flattened arch is thus made by the bow-like cross-pieces over the space between the canoes, upon which a board or a couple of stout poles laid lengthwise constitute an elevated platform for passengers and freight, while those who paddle and steer sit in the bodies of the canoes at the sides. A slender mast, which may be unstepped in a minute, rises from about the centre of this platform, to give support to a very simple sail, now universally made of white cotton cloth, but formerly of mats."



DOUBLE CANOE OF NEW CALEDONIA. Page 45.

The double canoes belonging to the chiefs of the South Sea islanders are the largest,—some of them being nearly seventy feet long, yet they are each only about two feet wide and three or four feet deep. The sterns are remarkably high—fifteen or eighteen feet above the water.

The war canoes are also large and compactly built; the stern being low and covered, so as to afford shelter from stones and darts. A rude imitation of a head or some grotesque figure is usually carved on the stern; while the stem is elevated, curved like the neck of a swan, and terminates frequently in the carved figure of a bird's head. These canoes are capable of holding fifty warriors. Captain Cook describes some as being one hundred and eight feet long. All of them, whether single or double, mercantile or war canoes, are propelled by paddles, the

men sitting with their faces in the direction in which they are going.

As may be supposed, these canoes are often upset in rough weather; but as the South Sea islanders are expert swimmers, they generally manage to right their canoes and scramble into them again. Their only fear on such occasions is being attacked by sharks. Ellis, in his interesting book, "Polynesian Researches," relates an instance of this kind of attack which was made upon a number of chiefs and people—about thirty-two—who were passing from one island to another in a large double canoe:— "They were overtaken by a tempest, the violence of which tore their canoes from the horizontal spars by which they were united. It was in vain for them to endeavour to place them upright again, or to empty out the water, for they could not prevent their incessant overturning. As their only resource, they collected the scattered spars and boards, and constructed a raft, on which they hoped they might drift to land. The weight of the whole number who were collected on the raft was so great as to sink it so far below the surface that they stood above their knees in water. They made very little progress, and soon became exhausted by fatigue and hunger. In this condition they were attacked by a number of sharks. Destitute of a knife or any other weapon of defence, they fell an easy prey to these rapacious monsters. One after another was seized and devoured, or carried away by them, and the survivors, who with dreadful anguish beheld their companions thus destroyed, saw the number of their assailants apparently increasing, as each body was carried off until only two or three remained.

"The raft, thus lightened of its load, rose to the surface of the water, and placed them beyond the reach of the voracious jaws of their relentless destroyers. The tide and current soon carried them to the shore, where they landed to tell the melancholy fate of their fellow-voyagers."

Captain Cook refers to the canoes of New Zealand thus:—

"The ingenuity of these people appears in nothing more than in their canoes. They are long and narrow, and in shape very much resemble a New England whale-boat. The larger sort seem to be built chiefly for war, and will carry from forty to eighty or a hundred armed men. We measured one which lay ashore at Tolaga; she was sixty-eight and a half feet long, five feet broad, and three and a half feet deep. The bottom was sharp, with straight sides like a wedge, and consisted of three lengths, hollowed out to about two inches, or one inch and a half thick, and well fastened together with strong plaiting. Each side consisted of one entire plank, sixty-three feet long, ten or twelve inches broad, and about one inch and a quarter thick; and these were fitted and lashed to the bottom part with great dexterity and strength.

"A considerable number of thwarts were laid from gunwale to gunwale, to which they were securely lashed on each side, as a strengthening to the boat. The ornament at the head projected five or six feet beyond the body, and was about four and a half feet high. The ornament at the stern was fixed upon that end as the stern-post of a ship is upon her keel, and was about fourteen feet high, two broad, and one inch and a half thick. They both consisted of boards of carved work, of which the design was much better than the execution. All their canoes, except a few at Opoorage or Mercury Bay, which were of one piece, and hollowed by fire, are built after this plan, and few are less than twenty feet long. Some of the smaller sort have outriggers; and sometimes two are joined together, but this is not common.

"The carving upon the stern and head ornaments of the inferior boats, which seemed to be intended wholly for fishing, consists of the figure of a man, with the

face as ugly as can be conceived, and a monstrous tongue thrust out of the mouth, with the white shells of sea-ears stuck in for eyes. But the canoes of the superior kind, which seem to be their men-of-war, are magnificently adorned with openwork, and covered with loose fringes of black feathers, which had a most elegant appearance. The gunwale boards were also frequently carved in a grotesque taste, and adorned with tufts of white feathers placed upon black ground. The paddles are small and neatly made. The blade is of an oval shape, or rather of a shape resembling a large leaf, pointed at the bottom, broadest in the middle, and gradually losing itself in the shaft, the whole length being about six feet. By the help of these oars they push on their boats with amazing velocity."

Mr Ellis, to whose book reference has already been made, and who visited the South Sea Islands nearly half a century later than Cook, tells us that the *single canoes* used by some of the islanders are far safer than the *double canoes* for long voyages, as the latter are apt to be torn asunder during a storm, and then they cannot be prevented from constantly upsetting.

Single canoes are not so easily separated from their outrigger. Nevertheless they are sometimes upset in rough seas; but the natives don't much mind this. When a canoe is upset and fills, the natives, who learn to swim like ducks almost as soon as they can walk, seize hold of one end of the canoe, which they press down so as to elevate the other end above the sea, by which means a great part of the water runs out; they then suddenly loose their hold, and the canoe falls back on the water, emptied in some degree of its contents. Swimming along by the side of it, they bale out the rest, and climbing into it, pursue their voyage.

Europeans, however, are not so indifferent to being overturned as are the savages.

On one occasion Mr Ellis, accompanied by three ladies, Mrs Orsmond, Mrs Barff, and his wife, with her two children and one or two natives, were crossing a harbour in the island of Huahine. A female servant was sitting in the forepart of the canoe with Mr Ellis's little girl in her arms. His infant boy was at its mother's breast; and a native, with a long light pole, was paddling or pushing the canoe along, when a small buhoe, with a native youth sitting in it, darted out from behind a bush that hung over the water, and before they could turn or the youth could stop his canoe, it ran across the outrigger. This in an instant went down, the canoe was turned bottom upwards, and the whole party precipitated into the sea.

The sun had set soon after they started from the opposite side, and the twilight being very short, the shades of evening had already thickened round them, which prevented the natives on shore from seeing their situation. The native woman, being quite at home in the water, held the little girl up with one hand, and swam with the other towards the shore, aiding at the same time Mrs Orsmond, who had caught hold of her long hair, which floated on the water behind her. Mrs Barff, on rising to the surface, caught hold of the outrigger of the canoe that had occasioned the disaster, and calling out loudly for help, informed the people on shore of their danger, and speedily brought them to their assistance. Mrs Orsmond's husband, happening to be at hand at the time, rushed down to the beach and plunged at once into the water. His wife, on seeing him, quitted her, hold of the native woman, and grasping her husband, would certainly have drowned both him and herself had not the natives sprung in and rescued them.

Mahinevahine, the queen of the island, leaped into the sea and rescued Mrs Barff; Mr Ellis caught hold of the canoe, and supported his wife and their infant until assistance came. Thus they were all saved.

The South Sea islanders, of whose canoes we have been writing, are—some of them at least—the fiercest savages on the face of the earth. They wear little or no clothing, and practise cannibalism—that is, *man-eating*—from choice. They actually prefer human flesh to any other. Of this we are informed on most unquestionable authority.

Doubtless the canoes which we have described are much the same now as they were a thousand years ago; so that, by visiting those parts of the earth where the natives are still savage, we may, as it were, leap backward into ancient times, and behold with our own eyes the state of marine architecture as it existed when our own forefathers were savages, and paddled about the Thames and the Clyde on logs, and rafts, and wicker-work canoes.

Chapter Four.

Ancient Ships and Navigators.

Everything must have a beginning, and, however right and proper things may appear to those who begin them, they generally wear a strange, sometimes absurd, aspect to those who behold them after the lapse of many centuries.

When we think of the trim-built ships and yachts that now cover the ocean far and wide, we can scarce believe it possible that men really began the practice of navigation, and first put to sea, in such grotesque vessels as that represented on page 55.

In a former chapter reference has been made to the rise of commerce and maritime enterprise, to the fleets and feats of the Phoenicians, Egyptians, and Hebrews in the Mediterranean, where commerce and navigation first began to grow vigorous. We shall now consider the peculiar structure of the ships and boats in which their maritime operations were carried on.

Boats, as we have said, must have succeeded rafts and canoes, and big boats soon followed in the wake of little ones. Gradually, as men's wants increased, the magnitude of their boats also increased, until they came to deserve the title of little ships. These enormous boats, or little ships, were propelled by means of oars of immense size; and, in order to advance with anything like speed, the oars and rowers had to be multiplied, until they became very numerous.

In our own day we seldom see a boat requiring more than eight or ten oars. In ancient times boats and ships required sometimes as many as four hundred oars to propel them.

The forms of the ancient ships were curious and exceedingly picturesque, owing to the ornamentation with which their outlines were broken, and the high elevation of their bows and sterns.

We have no very authentic details of the minutiae of the form or size of ancient ships, but antiquarians have collected a vast amount of desultory information, which, when put together, enables us to form a pretty good idea of the manner of working them, while ancient coins and sculptures have given us a notion of their general aspect. No doubt many of these records are grotesque enough, nevertheless they must be correct in the main particulars.

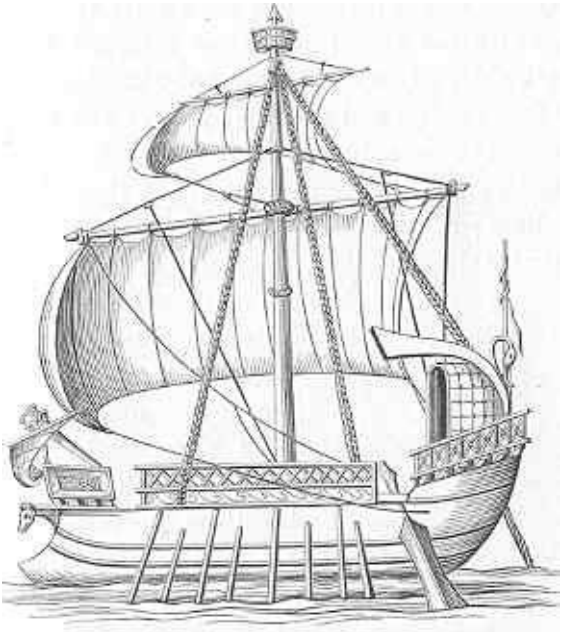
Homer, who lived 1000 B.C., gives, in his "Odyssey," an account of ship-building in his time, to which antiquarians attach much importance, as showing the ideas then prevalent in reference to geography, and the point at which the art of ship-building had then arrived. Of course due allowance must be made for Homer's tendency to indulge in hyperbole.

Ulysses, king of Ithaca, and deemed on of the wisest Greeks who went to Troy, having been wrecked upon an island, is furnished by the nymph Calypso with the means of building a ship,—that hero being determined to seek again his native shore and return to his home and his faithful spouse Penelope.

"Forth issuing thus, she gave him first to wield
A weighty axe, with truest temper steeled,
And double-edged; the handle smooth and plain,
Wrought of the clouded olive's easy grain;
And next, a wedge to drive with sweepy sway;
Then to the neighbouring forest led the way.
On the lone island's utmost verge there stood
Of poplars, pines, and firs, a lofty wood,
Whose leafless summits to the skies aspire,
Scorched by the sun, or seared by heavenly fire
(Already dried). These pointing out to view,
The nymph just showed him, and with tears withdrew.

"Now toils the hero; trees on trees o'erthrown
Fall crackling round, and the forests groan;
Sudden, full twenty on the plain are strewed,

And lopped and lightened of their branchy load.
At equal angles these disposed to join,
He smoothed and squared them by the rule and line.
(The wimbles for the work Calypso found),
With those he pierced them and with clinchers bound.
Long and capacious as a shipwright forms
Some bark's broad bottom to outride the storms,
So large he built the raft; then ribbed it strong
From space to space, and nailed the planks along.
These formed the sides; the deck he fashioned last;
Then o'er the vessel raised the taper mast,
With crossing sail-yards dancing in the wind:
And to the helm the guiding rudder joined
(With yielding osiers fenced to break the force
Of surging waves, and steer the steady course).
Thy loom, Calypso, for the future sails
Supplied the cloth, capacious of the gales.
With stays and cordage last he rigged the ship,
And, rolled on levers, launched her on the deep."



ROMAN SHIP.

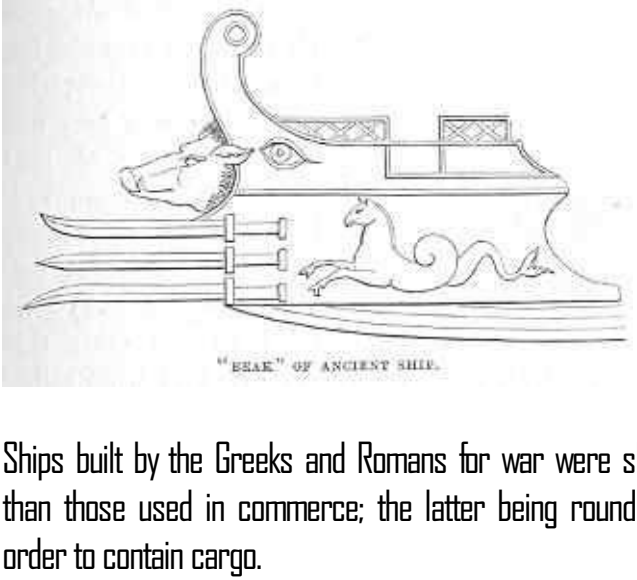
The ships of the ancient Greeks and Romans were divided into various classes, according to the number of "ranks" or "banks," that is, *rows*, of oars. *Monoremes* contained one bank of oars; *biremes*, two banks; *triremes*, three; *quadriremes*, four; *quinqueremes*, five; and so on. But the two latter were seldom used, being unwieldy, and the oars in the upper rank almost unmanageable from their great length and weight.

Ptolemy Philopator of Egypt is said to have built a gigantic ship with no less than forty tiers of oars, one above the other! She was managed by 4000 men, besides whom there were 2850 combatants; she had four rudders and a double prow. Her stern was decorated with splendid paintings of ferocious and fantastic animals; her oars protruded through masses of foliage; and her hold was filled with grain!

That this account is exaggerated and fanciful is abundantly evident; but it is highly probable that Ptolemy did construct one ship, if not more, of uncommon size.

MODE OF STEERING ANCIENT SHIP.

The sails used in these ships were usually square; and when there was more than one mast, that nearest the stern was the largest. The rigging was of the simplest description, consisting sometimes of only two ropes from the mast to the bow and stern. There was usually a deck at the bow and stern, but never in the centre of the vessel. Steering was managed by means of a huge broad oar, sometimes a couple, at the stern. A formidable "beak" was affixed to the fore-part of the ships of war, with which the crew charged the enemy. The vessels were painted black, with red ornaments on the bows; to which latter Homer is supposed to refer when he writes of red-cheeked

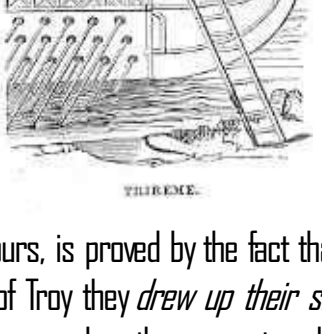


"BEAK" OF ANCIENT SHIP.

ships.

Ships built by the Greeks and Romans for war were sharper and more elegant than those used in commerce; the latter being round bottomed, and broad, in order to contain cargo.

The Corinthians were the first to introduce *triremes* into their navy (about 700 years B.C.), and they were also the first who had any navy of importance. The Athenians soon began to emulate them, and ere long constructed a large fleet of



TRIREME.

vessels both for war and commerce. That these ancient ships were light compared with ours, is proved by the fact that when the Greeks landed to commence the siege of Troy they *drew up their ships on the shore*. We are also told that ancient mariners, when they came to a long narrow

promontory of land, were sometimes wont to land, draw their ships bodily across the narrowest part of the isthmus, and launch them on the other side.

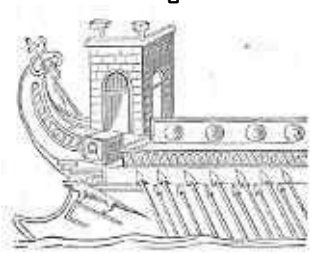
Moreover, they had a salutary dread of what sailors term "blue water"—that is, the deep, distant sea—and never ventured out of sight of land. They had no compass to direct them, and in their coasting voyages of discovery they were guided, if blown out to sea, by the stars.

The sails were made of linen in Homer's time; subsequently sail-cloth was made of hemp, rushes, and leather. Sails were sometimes dyed of various colours and with curious patterns. Huge ropes were fastened round the ships to bind them more firmly together, and the bulwarks were elevated beyond the frame of the vessels by wicker-work covered with skins.

Stones were used for anchors, and sometimes crates of small stones or sand; but these were not long of being superseded by iron anchors with teeth or flukes.

The Romans were not at first so strong in naval power as their neighbours, but in order to keep pace with them they were ultimately compelled to devote more attention to their navies. About 260 B.C. they raised a large fleet to carry on the war with Carthage. A Carthaginian quinquereme which happened to be wrecked on their coast was taken possession of by the Romans, used as a model, and one hundred and thirty ships constructed from it. These ships were all built, it is said, in six days; but this appears almost incredible. We must not, however, judge the power of the ancients by the standard of present times. It is well known that labour was cheap then, and we have recorded in history the completion of great works in marvellously short time, by the mere force of myriads of workmen.

The Romans not only succeeded in raising a considerable navy, but they proved themselves ingenious in the contrivance of novelties in their war-galleys.



TOWER ON BOARD ANCIENT SHIP.

They erected towers on the decks, from the top of which their warriors fought as from the walls of a fortress. They also placed small cages or baskets on the top of their masts, in which a few men were placed to throw javelins down on the decks of the enemy; a practice which is still carried out in principle at the present day, men being placed in the "tops" of the masts of our men-of-war, whence they fire down on the enemy. It was a bullet from the "top" of one of the masts of the enemy that laid low our greatest naval hero, Lord Nelson.

From this time the Romans maintained a powerful navy. They crippled the maritime power of their African foes, and built a number of ships with six and even ten ranks of oars. The Romans became exceedingly fond of representations of sea-fights, and Julius Caesar dug a lake in the Campus Martius specially for these exhibitions. They were not by any means sham fights. The unfortunates who manned the ships on these occasions were captives or criminals, who fought as the gladiators did—to the death—until one side was exterminated or spared by imperial clemency. In one of these battles no fewer than a hundred ships and nineteen thousand combatants were engaged!

Such were the people who invaded Britain in the year 55 B.C. under Julius Caesar,

and such the vessels from which they landed upon our shores to give battle to the then savage natives of our country.

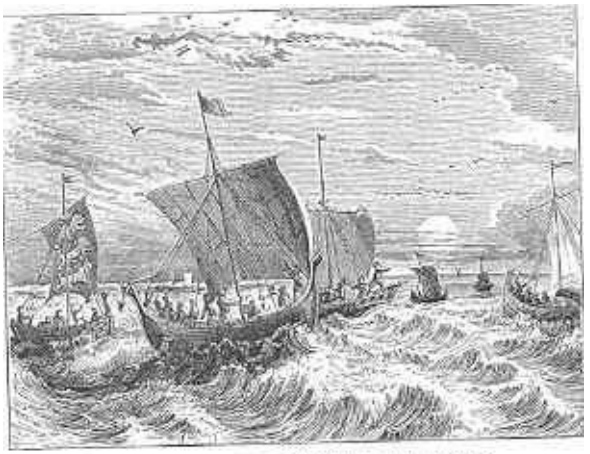
It is a curious fact that the crusades of the twelfth and thirteenth centuries were the chief cause of the advancement of navigation after the opening of the Christian era. During the first five hundred years after the birth of our Lord, nothing worthy of notice in the way of maritime enterprise or discovery occurred.

But about this time an event took place which caused the foundation of one of the most remarkable maritime cities in the world. In the year 476 Italy was invaded by the barbarians. One tribe, the Veneti, who dwelt upon the north-eastern shores of the Adriatic, escaped the invaders by fleeing for shelter to the marshes and sandy islets at the head of the gulf, whither their enemies could not follow by land, owing to the swampy nature of the ground, nor by sea, on account of the shallowness of the waters. The Veneti took to fishing, then to making salt, and finally to mercantile enterprises. They began to build, too, on those sandy isles, and soon their cities covered ninety islands, many of which were connected by bridges. And thus arose the far-famed city of the waters—"Beautiful Venice, the bride of the sea."

Soon the Venetians, and their neighbours the Genoese, monopolised the commerce of the Mediterranean.

The crusades now began, and for two centuries the Christian warred against the Turk in the name of Him who, they seem to have forgotten, if indeed the mass of them ever knew, is styled the Prince of Peace. One of the results of these crusades was that the Europeans engaged acquired a taste for Eastern luxuries, and the fleets of Venice and Genoa, Pisa and Florence, ere long crowded the

Mediterranean, laden with jewels, silks, perfumes, spices, and such costly merchandise. The Normans, the Danes, and the Dutch also began to take active part in the naval enterprise thus fostered, and the navy of France was created under the auspices of Philip Augustus.



ENGLISH SHIPS OF THE TIME OF THE CRUSADES.

The result of all this was that there was a great moving, and, to some extent, commingling of the nations. The knowledge of arts and manufactures was interchanged, and of necessity the knowledge of various languages spread. The West began constantly to demand the products of the East, wealth began to increase, and the sum of human knowledge to extend.

Shortly after this era of opening commercial prosperity in the Mediterranean, the hardy Northmen performed deeds on the deep which outrival those of the great Columbus himself, and were undertaken many centuries before his day.

The Angles, the Saxons, and the Northmen inhabited the borders of the Baltic, the

shores of the German Ocean, and the coasts of Norway. Like

NORSE GALLEY.

the nations on the shores of the Mediterranean, they too became famous navigators; but, unlike them, war and piracy were their chief objects of pursuit. Commerce was secondary.

In vessels resembling that of which the above is a representation, those nations went forth to plunder the dwellers in more favoured climes, and to establish the Anglo-Saxon dominion in England; and their celebrated King Alfred became the founder of the naval power of Britain, which was destined in future ages to rule the seas.

It was the Northmen who, in huge open boats, pushed off without chart or compass (for neither existed at that time) into the tempestuous northern seas, and, in the year 863, discovered the island of Iceland; in 983, the coast of Greenland; and, a few years later, those parts of the American coast now called Long Island, Rhode Island, Massachusetts, Nova Scotia, and Newfoundland. It is true they did not go forth with the scientific and commercial views of Columbus; neither did they give to the civilised world the benefit of their knowledge of those lands. But although their

purpose was simply selfish, we cannot withhold our admiration of the bold, daring spirit displayed by those early navigators, under circumstances of the greatest possible disadvantage—with undecked or half-decked boats, meagre supplies, no scientific knowledge or appliances, and the stars their only guide over the trackless waste of waters.

In the course of time, one or two adventurous travellers pushed into Asia, and men began to ascertain that the world was not the insignificant disc, or cylinder, or ball they had deemed it. Perhaps one of the chief among those adventurous travellers was Marco Polo, a Venetian, who lived in the latter part of the thirteenth century. He made known the central and eastern portions of Asia, Japan, the islands of the Indian Archipelago, part of the continent of Africa, and the island of Madagascar, and is considered the founder of the modern geography of Asia.

The adventures of this wonderful man were truly surprising, and although he undoubtedly exaggerated to some extent in his account of what he had seen, his narrations are for the most part truthful. He and his companions were absent on their voyages and travels twenty-one years.

Marco Polo died; but the knowledge of the East opened up by him, his adventures and his wealth, remained behind to stir up the energies of European nations. Yet there is no saying how long the world would have groped on in this twilight of knowledge, and mariners would have continued to "hug the shore" as in days gone by, had not an event occurred which at once revolutionised the science of navigation, and formed a new era in the history of mankind. This was the invention of the mariner's compass.

Chapter Five.

The Mariner's Compass—Portuguese Discoveries.

"What *is* the compass?" every philosophical youth of inquiring disposition will naturally ask. We do not say that all youths will make this inquiry. Many there are who will at once say, "Oh, I know! It's a needle with a card on the top of it—sometimes a needle with a card under it—which always points to the north, and shows sailors how to steer their ships."

Very well explained indeed, my self-sufficient friend; but you have not answered the question. You have told us what a compass is like, and one of the uses to which it is applied; but you have not yet told what it *is*. A man who had never heard of a compass might exclaim, "What! a needle! Is it a darning needle, or a knitting needle, or a drawing-through needle? And which end points to the north—the eye or the point? And if you lay it on the table the wrong end to the north, will it turn round of its own accord?"

You laugh, perhaps, and explain; but it would have been better to have explained correctly at first. Thus:—

The mariner's compass is a small, flat bar of magnetised steel, which, when balanced on a pivot, turns one of its ends persistently towards the north pole—the other, of course, towards the south pole; and it does this in consequence of its being magnetised. A card is fixed above, sometimes below, this bar of steel (which is called the needle), whereon are marked the cardinal points—north, south, east, and west—with their subdivisions or intermediate points, by means of which the

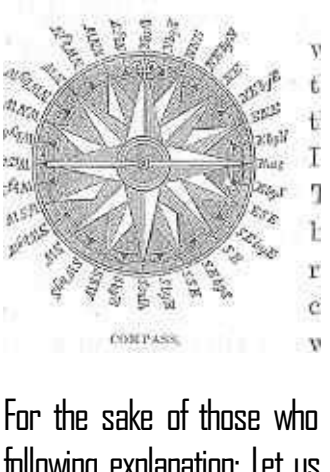
true direction of any point can be ascertained.

"Aha!" you exclaim, "Mr Author, but you yourself have omitted part of the explanation. *Why* is it that the magnetising of the needle causes it to turn to the north?"

I answer humbly, "I cannot tell;" but, further, I assert confidently, "Neither can anybody else." The fact is known, and we see its result; but the reason why magnetised steel or iron should have this tendency, this polarity, is one of the mysteries which man has not yet been able to penetrate, and probably never will.

Having explained the nature of the compass, as far as explanation is possible, we present our reader with a picture of one.

It will be seen that there are four large points—N, S, E, and W—the cardinal points above referred to, and that these are subdivided by twelve smaller points, with one little black triangular point between each, and a multitude of smaller points round the outer circle. To give these points their correct names is called "boxing the compass,"—a lesson which all seamen can trip off their tongues like A, B, C, and which most boys could learn in a few hours.



COMPASS.

For the sake of those who are anxious to acquire the knowledge, we give the following explanation: Let us begin with north. The large point midway between N and E (to the right) is *north-east*. The corresponding point midway between N and W (to the left) is *north-west*. A glance will show that the corresponding points towards the south are respectively *south-east* and *south-west* (usually written S.E. and S.W., as the two former points are written N.E. and N.W.). Now, to read off the compass with this amount of knowledge is very simple. Thus: *North, north-east, east, south-east, south, south-west, west, north-west, north*. But be it observed that, in the language of the sea, the *th* is thrown overboard, except when the words north and south occur alone. When conjoined with other points they are pronounced thus: nor'-east, sou'-east; and so on.

To come now to the smaller subdivisions, it will suffice to take a quarter of the circle. The point midway between N.E. and N. is "nor'-nor'-east" (N.N.E.), and the corresponding one between N.E. and E. is "east nor'-east" (E.N.E.). These points are again subdivided by little black points which are thus named:— The first, next the N., is "north by east" (N. by E.); the corresponding one next the E. is "east by north" (E. by N.). The second *black* point from N. is "nor'-east by north" (N.E. by N.),

and the corresponding one—namely, the second black point from east—is "nor'-east by east" (N.E. by E.). Thus, in reading off the compass, we say—beginning at north and proceeding to east—North: north by east; nor'-nor'-east; nor'-east by north; nor'-east; nor'-east by east; east nor'-east; east by north; east;—and so on with the other quarters of the circle.

So much for "boxing the compass." The manner in which it is used on board ship, and the various instruments employed in connection with it in the working of a vessel at sea, will be explained shortly; but first let us glance at the history of the compass.

It is a matter of great uncertainty when, where, and by whom the mariner's compass was invented. Flavio Gioia, a Neapolitan captain or pilot, who lived about the beginning of the fourteenth century, was generally recognised throughout Europe as the inventor of this useful instrument; but time and research have thrown new light on this subject. Probably the Neapolitan pilot was the first who brought the compass into general notice in Europe; but long before 1303 (the year in which it was said to have been invented) the use of the magnetic needle was known to the Chinese.

Loadstone, that mineral which has the mysterious power of attracting iron, and also of imparting to iron its own attractive power, was known to the Chinese before the year 121, in which year a famous Chinese dictionary was completed, wherein the word *magnet* is defined as "the name of a stone which gives direction to a needle." This proves not only that they knew the attractive properties of the loadstone, and its power of imparting these properties to metal, but also that they were aware of the polarity of a magnetised needle. Another Chinese dictionary, published between

the third and fourth centuries, speaks of ships being guided in their course to the south by means of the magnet; and in a medical work published in China in 1112, mention is made of the *variation* of the needle, showing that the Chinese had not only used the needle as a guide at sea, but had observed this one of its well-known peculiarities—namely, the tendency of the needle to point in a *very slight degree* away from the true north.

In the thirteenth century, too, we find mention made of the needle by a poet and by two other writers; so that whatever Flavio Gioia may have done (and it is probable he did much) in the way of pushing the compass into notice in Europe, he cannot be said to be the inventor of it. That honour doubtless belongs to the Chinese. Be this as it may, the compass was invented; and in the fourteenth century it began that revolution in maritime affairs to which we have alluded.

The first compasses were curiously formed. The Chinese used a magnetised needle, which they placed in a bit of rush or pith, which was floated in a basin of water, and thus allowed to move freely and turn towards the poles. They also made needles in the form of iron fish. An Arabian author of the thirteenth century thus writes:— "I heard it said that the captains in the Indian seas substitute for the needle and reed a hollow iron fish magnetised, so that, when placed in the water, it points to the north with its head and to the south with its tail. The reason that the iron fish does not sink, is that metallic bodies, even the heaviest, float when hollow and when they displace a quantity of water greater than their own weight."

The use of the compass at sea is so simple, that, after what has been said, it scarcely requires explanation. When a ship sets sail for any port, she knows, first of all, the position of the port from which she sets sail, as well as that to which she

is bound. A straight line drawn from the one to the other is her true course, supposing that there is deep, unobstructed water all the way; and if the compass be placed upon that line, the point of the compass through which it passes is the point by which she ought to steer. Suppose that her course ran through the east point of the compass: the ship's head would at once be turned in that direction, and she would continue her voyage with the needle of the compass pointing straight *across* the deck, and the east and west points straight *along* it.

But various causes arise in the actual practice of navigation to prevent a ship keeping her true course. Winds may be contrary, and currents may drive her either to the one side or the other of it; while land—promontories, islands, and shallows—compel her to deviate from the direct line. A vessel also makes what is called "leeway," which means that, when the wind blows on her side, she not only advances forward, but also slides through the water sidewise. Thus, in the course of a day, she may get a considerable distance off her true course—in sea parlance, "make a good deal of leeway."

To perform the voyage correctly and safely in the face of these obstacles and hindrances is the aim and end of navigation; and the manner of proceeding is as follows:—

The hour is carefully noted on setting sail, and from that moment, night and day, to the end of the voyage, certain observations are made and entered in the ship's journal, called the log. Every hour the rate at which the ship is going is ascertained and carefully noted. The point of the compass towards which the ship is to be steered is given by the captain or officer in command to the steersman, who stands at the wheel with a compass always before him in a box called the

"*binnacle*." The course is never changed except by distinct orders from those in command; and when it is changed, the hour when the change is made and the new course to be steered are carefully noted down. Thus, at the end of the day, or at any other time if desired, the position of the ship can be ascertained by her course being drawn upon a chart of the ocean over which she is sailing,—correct charts, or maps, being provided by the captain before starting.

The estimate thus made is, however, not absolutely correct. It is called the "*dead-reckoning*," and is only an approximation to the truth, because allowance has to be made for leeway, which can only be guessed at. Allowance has also to be made for variations in the rate of sailing in each hour, for the winds do not always blow with exactly the same force during any hour of the day. On the contrary, they may vary several times within an hour, both in force and in direction. Those variations have to be watched and allowed for; but such allowance may be erroneous in a greater or less degree. Currents, too, may have exerted an unseen influence on the ship, thus rendering the calculation still less correct. Nevertheless, dead-reckoning is often the only guide the sailor has to depend upon for days at a time, when storms and cloudy skies prevent him from ascertaining his true position by other means, of which we shall speak presently.

Of course, in the early days of navigation there were no charts of the ocean. The navigator knew not whither he was hurrying over the wild waste of waters; but by observing the relative position of some of the fixed stars to his course while sailing out to sea, he could form a rough idea of the proper course to steer in order to return to the port whence he had started.

The compass, then, shows the sailor the course he has been going, and the *log* (of

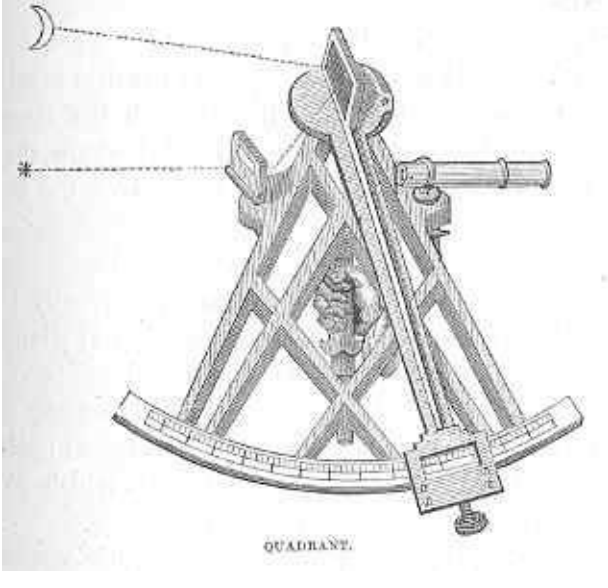
which more presently) enables him to ascertain the rate at which he has proceeded; while his chronometers, or time-keepers, tell him the *time* during which the course and rate of sailing have been kept up. And many a long cruise on the unknown deep has been successfully accomplished in days of old by bold seamen, with this method of dead-reckoning; and many a mariner at the present day depends almost entirely on it, while *all* are, during thick, stormy weather, dependent on it for days and sometimes weeks together.

The *log*, to which we have referred, is the instrument by which is determined the rate at which a ship is progressing. It is a very simple contrivance: a triangular piece of wood about the size of a large saucer, with a piece of stout cord fastened to each corner, the ends of the cords being tied together, so that when held up, the "log," as it is called, resembles one of a pair of scales. One of the cords, however, is only temporarily attached to its corner by means of a peg, which when violently pulled comes out. One edge of the triangle is loaded with lead. The whole machine is fastened to the "log-line,"—a stout cord many fathoms long, which is wound on a large reel.

"Heaving the log," as we have said, takes place every hour. One sailor stands by with a sand-glass which runs exactly half a minute. Another holds the wooden reel; and a third heaves the log overboard, and "pays out" line as fast as he can make the reel spin. The instant it is thrown the first sailor turns the sand-glass. The log, being loaded on one side, floats perpendicularly in the water, remaining stationary of course; while the man who hove it watches sundry knots on the line as they pass over the stern of the ship, each knot representing a mile of rate of speed in the hour. As the last grain of sand drops to the bottom of the glass the first sailor gives a sharp signal, and the second clutches and checks the line, examines the

knot nearest his hand, and thus knows at once how many knots or miles the ship is sailing at that time. The sudden stoppage of the line jerks the peg, before referred to, out of the log, thereby allowing the other two fixed cords to drag it flat and unresisting over the surface of the sea, when the line is reeled up and put by. The flight of another hour calls for a repetition of the heaving of the log.

As scientific knowledge advanced, instruments of peculiar and more complicated form were devised to enable navigators to ascertain more correctly their position on the surface of the sea; but they did not, and never will, supersede the method by dead-reckoning—for this reason, that the latter can be practised at all times, while the former are useless unless the sun, moon, or stars be visible, which in some latitudes they are not for many days and weeks, when clouds and fogs shroud the bright sky from view.



QUADRANT.

The *Quadrant* is the chief of those instruments. It is represented on next page. To give a succinct account of this would take up more space than we can spare. It may suffice the general reader to say that by observing the exact position of the sun at noon, or of the moon or a star, in relation to the horizon, the precise *latitude* of a ship—that is, her distance north or south of the equator—is ascertained. The method of "taking an observation" is complicated, and difficult to explain and understand. We refer those who are curious on the point to treatises on navigation.

Chronometers are exceedingly delicate and perfect time-keepers, or watches, which are very carefully set at the commencement of a voyage. Thus the *time* at the *meridian* whence a vessel starts is kept up during the voyage. By means of an observation of the sun with the quadrant, or sextant (a somewhat similar instrument), the true time at any particular point in the voyage may be ascertained. A *difference* is found to exist between the time at the spot where the observation is taken, and the time of the chronometer. A calculation founded on this difference gives the ship's *longitude*—that is, her distance east or west of the meridian that passes through Greenwich. That meridian is an imaginary line drawn round the world longitudinally, and passing through the north and south poles, as the equator is a line passing round it latitudinally.

When a ship's latitude and longitude have been ascertained, and a line drawn through the first parallel to the equator, and another line through the second parallel to the first meridian, the point where these two lines intersect is the *exact* position of the ship upon the sea.

The size and form of ships having gradually improved, the compass and other

scientific appliances having been discovered, cannon also and gunpowder having been invented, seamen became more courageous and venturesome; and at last the Portuguese nation began that career of maritime enterprise which won for it the admiration of the world.

About the beginning of the fourteenth century (1330), the Canary Islands, lying off the west coast of Africa, were re-discovered by the accident of a French ship being blown off the coast in a storm, and finding shelter amongst them. This group had been known to the ancients under the name of the Fortunate Islands, but had been forgotten for more than a thousand years. During the course of the century the Spaniards plucked up courage to make discoveries and settlements upon them, although by so doing they were compelled to undergo that much-dreaded ordeal—sailing *out of sight* of their once fondly "hugged" land!

In the beginning of the next century arose a prince, Don Henry, son of John the First of Portugal, whose anxiety to promote discovery, and to find a passage by sea round the coast of Africa to India, induced him to send out many expeditions, all of which accomplished something, and many of which added very extensively to the geographical knowledge of the world at that time. Navigators, sent out by him from time to time, discovered the Madeira Islands; sailed along the western coast of Africa a considerable distance; ascertained the presence of gold-dust among the savages on the Gulf of Guinea; discovered the Azores, besides numerous other islands and lands; crossed the equator, and approached to within about eighteen hundred miles of the south-most cape of Africa.

The discovery of gold-dust stirred up the energies of the Portuguese in a remarkable degree, and caused them cheerfully to undertake ventures which,

without that inducement, they would probably never have undertaken at all. Moreover, they had now learned to quail less at the idea of losing sight of land; and towards the end of the fifteenth century (1486), Bartholomew Diaz, an officer of the household of John the Second, achieved the grand object which had long been ardently desired by the Portuguese—he doubled the great southern cape of Africa, which King John named the "Cape of Good Hope," although Diaz had named it the "Cape of Tempests." The circumstance is thus alluded to by a poet of that period—

"At Lisboa's court they told their dread escape,
And from her raging tempests named the Cape.
'Thou southmost point,' the joyful king exclaimed,
'*Cape of Good Hope* be thou for ever named!'"

Chapter Six.

Boats, Model-Boat Making, etcetera.

Leaving the subject of ancient ships and navigation, we shall now turn our attention to the more recent doings of man on the ocean, and, before entering into the details of ships and ship-building, devote a little time and space to the consideration of boats.

There are great varieties of boats—as regards shape, size, material, and use—so that it is not easy to decide on which we shall first fix our attention. There are large and small, long and short boats; flat, round, sharp, and bluff ones,—some clumsy, others elegant. Certain boats are built for carrying cargo, others for purposes of

war. Some are meant for sailing, some for rowing; and while many kinds are devoted to business, others are intended solely for pleasure. Before we refer to any of these, perhaps our young readers will not object to be told how to construct:—

A Model Boat.

We need scarcely say that it is not expedient for a boy to attempt to build a model boat in the same manner as a regular boat-builder constructs one for actual service. It would be undertaking an unnecessary amount of labour to lay a keel and form ribs and nail on planks in the orthodox fashion, because, for all practical purposes, a boat cut out of a solid block of wood is quite as useful, and much more easily made.

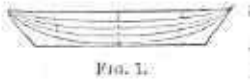


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

The first thing you have to do, my young boat-builder, then, is to go and visit a harbour or beach where varieties of boats are to be found, and, having settled in your mind which of them you intend to copy, make a careful drawing, in outline, of its form in four different positions. First, a side view, as in Figure 1. Then the stern, with the swelling sides of the boat visible, as in Figure 2. The bow, as in Figure 3; and a bird's-eye view, as in Figure 4. The last drawing can be made by mounting on some neighbouring eminence, such as a bank or a larger boat, or, if that is impossible, by getting upon the stern of the boat itself, and thus looking down on it. These four drawings will be of great service in enabling you to shape your model

correctly; for as you proceed with the carving you can, by holding the model up in the same position with any of the drawings, ascertain whether you are progressing properly; and if you get the correct form of your boat in these four positions, you will be almost certain to make a good boat. If, on the other hand, you go to work without drawings, the probability is that your boat will be lopsided, which will prevent it from floating evenly; or crooked, which will tend to check its speed in sailing, besides being clumsy and not "ship-shape," as the sailors have it.

Figure 1 will keep you right in regard to relative length and depth; Figure 2 in regard to shape of stern and bulge of the sides; Figure 3 secures correct form of the bow; and Figure 4 enables you to proportion the breadth to the length.

The next thing to be done is to procure a block of fir-wood, with as few knots in it as possible, and straight in the grain. The size is a matter of choice—any size from a foot to eighteen inches will do very well for a model boat. Before beginning to carve this, it should be planed quite smooth and even on all sides, and the ends cut perfectly square, to permit of the requisite pencil-drawings being made on it.

The tools required are a small tenon-saw, a chisel, two or three gouges of different sizes, a spoke-shave, and a file with one side flat and the other round. A rough rasp-file and a pair of compasses will also be found useful. All of these ought to be exceedingly sharp. The gouges and the spoke-shave will be found the most useful of these implements.

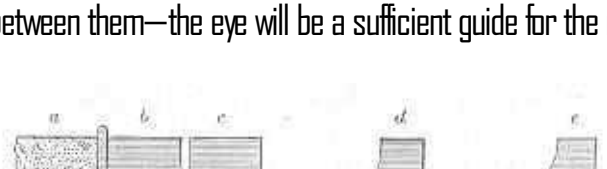
Begin by drawing a straight line with pencil down the exact centre of what will be the deck; continue it down the part that will be the stern; then carry it along the bottom of the block, where the keel will be, and up the front part, or bow. If this line

has been correctly drawn, the end of it will exactly meet the place where you began to draw it. On the correctness of this line much will depend; therefore it is

necessary to be careful and precise in finding out the centre of each surface of the block with the compasses. Next, draw a line on each side of this centre line (as in the accompanying diagram), which will give the thickness of the keel and stern-post. Then on the upper surface of the block draw the form of the boat to correspond with the bird's-eye view (Figure 4, on page 82) already referred to. Then draw *one-half* of the stern on a piece of thin card-board, and when satisfied that it is correct cut it out with scissors; apply it to the model, first on one side, and then on the other side of the stern-post. By thus using a pattern of only one-half of the stern, exact uniformity of the two sides is secured. Treat the bow in the same way. Of course the pattern of the bow will at first be drawn on the *flat* surface of the block, and it will represent not the actual bow, but the thickest part of the hull, as seen in the position of Figure 3, on page 82. After this, turn the side of the block, and draw the form represented in Figure 1, page 82, thereon, and mark *on the keel* the point where the stem and keel join, and also where the stern and keel join. This is necessary, because in carving the sides of the boat these lines will be among the first to be cut away. The next proceeding is to cut away at the sides and bottom of the block until, looking at it in the proper positions, the bow resembles Figure 3, and the stern Figure 2, above referred to. This will be done chiefly with the gouge, the chisel and spoke-shave being reserved for finishing.

Then saw off the parts of the bow and stern that will give the requisite slope to these parts, being guided by the marks made on the keel. In cutting away the upper parts of the bow and stern, be guided by the curved lines on the deck; and in forming the lower parts of the same portions, keep your eye on your drawing, which is represented by Figure 1.

It is advisable to finish one side of the boat first, so that, by measurement and comparison, the other side may be made exactly similar. Those who wish to be very particular on this point may secure almost exact uniformity of the two sides by cutting out several moulds (three will be sufficient) in card-board. These moulds must be cut so as to fit three marked points on the *finished* side, as represented by three dotted lines on Figure 1; and then the unfinished side must be cut so as to fit the moulds at the corresponding points. If the two sides are quite equal at these three points, it is almost impossible to go far wrong in cutting away the wood between them—the eye will be a sufficient guide for the rest.



The accompanying diagram shows the three moulds referred to, one of them being *nearly* applied to the finished part of the hull to which it belongs. Thus—(a) represents the unfinished side of the boat; (b) the finished side; (c) is the mould or card cut to correspond with the widest part of the finished side, near the centre of the boat; (d) is the mould for the part near the bow; (e) for that near the stern.

These drawings are roughly given, to indicate the plan on which you should proceed. The exact forms will depend on your own taste or fancy, as formed by the variously-shaped boats you have studied. And it may be remarked here, that all we have said in regard to the cutting out of model boats applies equally to model ships.

VIEW OF THE BOW.

The outside of your boat having been finished, the bow having been fashioned somewhat like that represented in the accompanying cut, and the stern having been shaped like that shown in the illustration given below, the next thing to be done is to hollow out the hull. Care must be taken in doing this not to cut away too much wood from one part, or to leave too much at another; a little more than half an inch of thickness may be left everywhere. Next, fix in the thwarts, or seats, as in the foregoing cut, attach a leaden keel, and the boat is completed.

VIEW OF THE STERN.

The keel may be formed by running melted lead into a groove cut in a piece of wood, or, better still, into a groove made in nearly dry clay. By driving four or five nails (well greased) into the groove before pouring in the melted lead, holes may be formed in the keel by simply withdrawing the nails after it is cold.

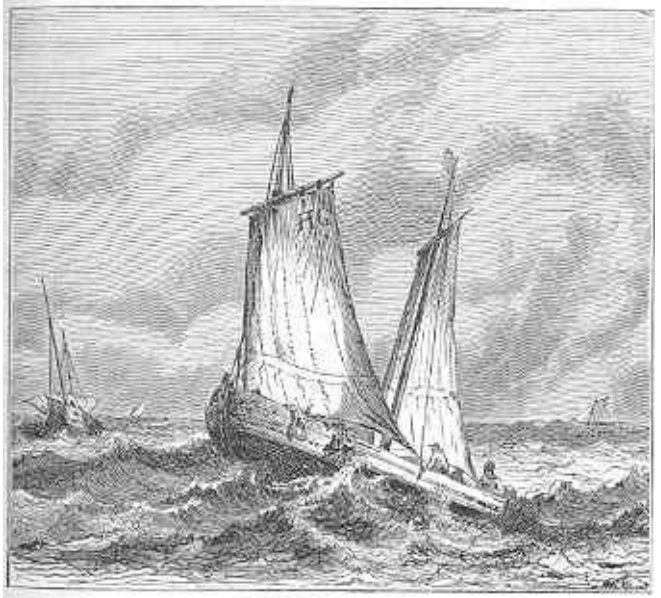
A mast and sail, however, are still wanted. The best kind of sail is the lug, which is an elongated square sail—shown in the accompanying illustration.

LUG-SAIL.

Most of our fishing-boats are provided with lug-sails, and on this account are

styled luggers. These boats are of all sizes, some of them being fifty tons burden, and carrying crews of seven or ten men each. A picture of a lugger is given on the next page.

Great numbers of fishing-boats may be seen at Great Yarmouth, and all along the coasts of Norfolk and Suffolk. They are employed in the herring-fishery, and use nets, which are let down in deep water, corks floating the upper edges of the nets, and the lower edges being sunk by leads, so that they remain in the water perpendicularly like walls, and intercept the shoals of



LUGGER FISHING-BOAT.

herring when they chance to pass. Thousands of these glittering silvery fish get entangled in the meshes during night. Then the nets are drawn up, and the fish taken out and thrown into a "well," whence they are removed as quickly as possible, and salted and packed in lockers; while the nets are let down again into the sea. These boats

remain out usually a week at a time. Most of them return to port on Saturday, in order to spend Sunday as a day of rest. Some, however—regardless of the fact that He who gives them the fish with such liberal hand, also gave them the command, "Remember the sabbath day"—continue to prosecute the fishing on that day. But many a good man among the fishermen has borne testimony to the fact that these do not gain additional wealth by their act of disobedience; while they lose in the matter of nets (which suffer from want of frequent drying) and in the matter of health (which cannot be maintained so well without a weekly day of rest), while there can be no doubt that they lose the inestimable blessing of a good conscience. So true is it that godliness is profitable for the life which now is as well as for that which is to come.

A model boat should be rigged with only one mast and lug-sail, or with two masts and sails at the most. Three are unnecessary and cumbrous. Each sail should be fixed to a yard, which should be hoisted or hauled down by means of a block or pulley fastened near the top of the mast. The positions of these yards and the form of the sails may be more easily understood by a glance at our woodcut than by reading many pages of description.

Sprit-sails are sometimes used in boats. These are fore-and-aft sails, which are kept distended by a sprit instead of a yard. The sprit is a long pole, one end of which is fixed to the lowest *innermost* corner, near the mast, and the other end extending to the highest *outermost* corner; thus it lies diagonally across the sail. It is convenient when a boat "tacks," or "goes about"—in other words, when it goes round frequently, and sails, now leaning on one side, and, at the next tack, on the other side. In this case the sprit requires little shifting or attention. But it is dangerous in squally weather, because, although the sheet or line which holds the

lower and *outer* end of a sail may be let go for the sake of safety, the upper part remains spread to the wind because of the sprit.

The best rig of all for a model boat, and indeed for a pleasure-boat, is that which comprises a main-sail, in form like that of a sloop or a cutter, omitting the boom, or lower yard, and a triangular fore-sail extending from near the mast to the bow of the boat or to the end of the bowsprit—somewhat like a sloop's jib. Both of the sails referred to may be seen at the part of this book which treats of sloops and cutters; and they are the same in form, with but slight modification, when applied to boats.

Racing-boats are long, low, narrow, and light. Some are so narrow as to require iron rowlocks extending a considerable distance beyond the sides of the boat for the oars to rest in. Many of these light craft may be seen on the Thames and Clyde, and other rivers throughout the kingdom. The larger sort do not require what we may call the outrigger rowlocks.

The "Rob Roy" canoe has, of late years, come much into fashion as a racing and pleasure boat. Whatever the advantages of this craft may be, it has this disadvantage, that it can hold only one person; so that it may be styled an unsocial craft, the company of one or more friends being impossible, unless, indeed, one or more canoes travel in company.

This species of canoe became celebrated some years ago, in consequence of an interesting and adventurous voyage of a thousand miles through Germany, Switzerland, and France, and, subsequently, through part of Norway and Sweden, made by Mr Macgregor in a craft of this kind, to which he gave the name of "Rob

Roy." Since the craft became popular, numerous and important improvements have been made in the construction of its hull and several parts, but its distinctive features remain unaltered. The "Rob Roy" canoe is, in fact, almost identical with the Eskimo kayak, except in regard to the material of which it is made—the former being composed wholly of wood, the latter of a framework of wood covered with skin. There is the same long, low, fish-like form, the same deck, almost on a level with the water, the same hole in the centre for the admission of the man, the same apron to keep out water, and the same long, double-bladed paddle, which is dipped on each side alternately. The "Rob Roy" has, however, the addition of a small mast, a lug-sail, and a jib. It has also a back-board, to support the back of the canoeman; the paddle, too, is somewhat shorter than that of the Eskimo canoe; and the whole affair is smarter, and more in accordance with the tastes and habits of the civilised men who use it.

In his various voyages, which we might almost style journeys, the originator of the "Rob Roy" canoe proved conclusively that there were few earthly objects which could form a barrier to his progress. When his canoe could not carry him, he carried it! Waterfalls could not stop him, because he landed below them, and carried his canoe and small amount of baggage to the smooth water above the falls. In this he followed the example of the fur-traders and Indians of North America, who travel over any number of miles of wilderness in this manner. Shallows could not stop him, because his little bark drew only a few inches of water. Turbulent water could not swamp him, because the waves washed harmlessly over his smooth deck, and circled innocently round his protective apron. Even long stretches of dry land could not stop him, because barrows, or carts, or railways could transport his canoe hither and thither with perfect ease to

any distance; so that when the waters of one river failed him, those of the next nearest were easily made available. In conclusion, it may be said that the "Rob Roy" canoe is a most useful and pleasant craft for boys and young men, especially at those watering-places which have no harbour or pier, and where, in consequence of the flatness of the beach, boats cannot easily be used.

RIVER-BOAT.

It would be an almost endless as well as unprofitable task to go over the names and characteristics of all our various kinds of boats in detail.

Of heavy-sterned and clumsy river craft, we have an innumerable fleet.

There are also *Torbay Trawlers*, which are cutters of from twenty to fifty tons; and the herring-boats of Scotland; and cobbles, which are broad, bluff, little boats; and barges, which are broad, bluff, large ones; and skiffs, and scows, and many others.

In foreign lands many curious boats are to be met with. The most graceful of them, perhaps, are those which carry lateen sails—enormous triangular sails, of which kind each boat usually carries only one.

India-rubber boats there are, which can be inflated with a pair of bellows, and, when full, can support half-a-dozen men or more, while, when empty, they can be rolled up and carried on the back of one man, or in a barrow. One boat of this kind we once saw and paddled in. It was made in the form of a cloak, and could be carried quite easily on one's shoulders. When inflated, it formed a sort of oval canoe, which was quite capable of supporting one person. We speak from experience, having tried it some years ago on the Serpentine, and found it to be extremely buoyant, but a little given to spin round at each stroke of the paddle, owing to its circular shape and want of cut-water or keel.

Of all the boats that swim, the lifeboat is certainly one of the most interesting; perhaps it is not too much to add that it is also one of the most useful. But this boat deserves a chapter to itself.

Chapter Seven.

Lifeboats and Lightships.

When our noble Lifeboat Institution was in its infancy, a deed was performed by a young woman which at once illustrates the extreme danger to which those who attempt to rescue the shipwrecked must expose themselves, and the great need there was, thirty years ago, for some better provision than existed at that time for the defence of our extensive sea-board against the dire consequences of storm and wreck. It is not, we think, inappropriate to begin our chapter on lifeboats with a brief account of the heroic deed of:—

Grace Darling.

There are not many women who, like Joan of Arc, put forth their hands to the work peculiarly belonging to the male sex, and achieve for themselves undying fame. And among these there are very few indeed who, in thus quitting their natural sphere and assuming masculine duties, retain their feminine modesty and gentleness.

Such a one, however, was Grace Darling. She did not, indeed, altogether quit her station and follow a course peculiar to the male sex; but she did once seize the oar and launch fearlessly upon the raging sea, and perform a deed which strong and daring men might have been proud of—which drew forth the wondering admiration of her country, and has rendered her name indissolubly connected with the annals of heroic daring in the saving of human life from vessels wrecked upon our rock-bound shores.

Grace Darling was born in November 1815, at Bamborough, on the Northumberland coast. Her father was keeper of the lighthouse on the Longstone, one of the Farne Islands lying off that coast; and here, on a mere bit of rock surrounded by the ocean, and often by the howling tempests and the foaming breakers of that dangerous spot, our heroine spent the greater part of her life, cut off almost totally from the joys and pursuits of the busy world. She and her mother managed the domestic economy of the lighthouse on the little islet, while her father trimmed the lantern that sent a blaze of friendly light to warn mariners off that dangerous coast.

In personal appearance Grace Darling is described as having been fair and comely, with a gentle, modest expression of countenance; about the middle size;

and with nothing in the least degree masculine about her. She had reached her twenty-second year when the wreck took place in connection with which her name has become famous.

The Farne Islands are peculiarly dangerous. The sea rushes with tremendous force between the smaller islands, and, despite the warning light, wrecks occasionally take place among them. In days of old, when men had neither heart nor head to erect lighthouses for the protection of their fellows, many a noble ship must have been dashed to pieces there, and many an awful shriek must have mingled with the hoarse roar of the surf round these rent and weatherworn rocks.

A gentleman who visited the Longstone rock in 1838, describes it thus:—

"It was, like the rest of these desolate isles, all of dark whinstone, cracked in every direction, and worn with the action of winds, waves, and tempests since the world began. Over the greater part of it was not a blade of grass, nor a grain of earth; it was bare and iron-like stone, crusted, round all the coast as far as high-water mark, with limpet and still smaller shells. We ascended wrinkled hills of black stone, and descended into worn and dismal dells of the same; into some of which, where the tide got entrance, it came pouring and roaring in raging whiteness, and churning the loose fragments of whinstone into round pebbles, and piling them up in deep crevices with seaweeds, like great round ropes and heaps of fucus. Over our heads screamed hundreds of hovering birds, the gull mingling its hideous laughter most wildly."

One wild and stormy night in September 1838—such a night as induces those on land to draw closer round the fire, and offer up, perchance, a silent prayer for

those who are at sea—a steamer was battling, at disadvantage with the billows, off Saint Abb's Head. She was the *Forfarshire*, a steamer of three hundred tons, under command of Mr John Humble; and had started from Hull for Dundee with a valuable cargo, a crew of twenty-one men, and forty-one passengers.

It was a fearful night. The storm raged furiously, and would have tried the qualities of even a stout vessel; but this one was in very bad repair, and her boilers were in such a state that the engines soon became entirely useless, and at last they ceased to work. We cannot conceive the danger of a steamer left thus comparatively helpless in a furious storm and dark night off a dangerous coast.

In a short time the vessel became quite unmanageable, and drifted with the direction of the tide, no one knew whither. Soon the terrible cry arose, "Breakers to leeward," and immediately after the Farne lights became visible. A despairing attempt was now made by the captain to run the ship between the islands and the mainland; but in this he failed, and about three o'clock she struck heavily on a rock bow foremost.

The scene of consternation that followed is indescribable. Immediately one of the boats was lowered, and with a freight of terror-stricken people pushed off, but not before one or two persons had fallen into the sea and perished in their vain attempts to get into it. This party in the boat, nine in number, survived the storm of that awful night, and were picked up the following morning by a Montrose sloop. Of those left in the ill-fated ship some remained in the after-part; a few stationed themselves near the bow, thinking it the safest spot. The captain stood helpless, his wife clinging to him, while several other females gave vent to their agony of despair in fearful cries.

Meanwhile the waves dashed the vessel again and again on the rock, and at last a larger billow than the rest lifted her up and let her fall down upon its sharp edge. The effect was tremendous and instantaneous; the vessel was literally broken in two pieces, and the after-part, with the greater number of the passengers in the cabin, was swept away through the Fifa Gut, a tremendous current which is considered dangerous even in good weather. Among those who thus perished were the captain and his wife. The forepart of the steamer, with the few who had happily taken refuge upon it, remained fast on the rock. Here eight or nine of the passengers and crew clung to the windlass, and a woman named Sarah Dawson, with her two little children, lay huddled together in a corner of the fore-cabin, exposed to the fury of winds and waves all the remainder of that dreadful night. For hours each returning wave carried a thrill of terror to their hearts; for the shattered wreck reeled before every shock, and it seemed as if it would certainly be swept away into the churning foam before daybreak.

But daylight came at last, and the survivors on the wreck began to sweep the dim horizon with straining eyeballs as a faint hope at last began to arise in their bosoms. Nor were these trembling hopes doomed to disappointment. At the eleventh hour God in his mercy sent deliverance. Through the glimmering dawn and the driving spray the lighthouse-keeper's daughter from the lonely watch-tower descried the wreck, which was about a mile distant from the Longstone. From the mainland, too, they were observed; and crowds of people lined the shore and gazed upon the distant speck, to which, by the aid of telescopes, the survivors were seen clinging with the tenacity of despair.

But no boat could live in that raging sea, which still lashed madly against the riven rocks, although the violence of the storm had begun to abate. An offer of 5 pounds

by the steward of Bamborough Castle failed to tempt a crew of men to launch their boat. One daring heart and willing hand was there, however. Grace Darling, fired with an intense desire to save the perishing ones, urged her father to launch their little boat. At first he held back. There was no one at the lighthouse except himself, his wife, and his daughter. What could such a crew do in a little open boat in so wild a sea? He knew the extreme peril they should encounter better than his daughter, and very naturally hesitated to run so great a risk. For, besides the danger of swamping, and the comparatively weak arm of an inexperienced woman at the oar, the passage from the Longstone to the wreck could only be accomplished with the ebb-tide; so that unless the exhausted survivors should prove to be able to lend their aid, they could not pull back again to the lighthouse.

But the earnest importunities of the heroic girl were not to be resisted. Her father at last consented, and the little boat pushed off with the man and the young woman for its crew. It may be imagined with what a thrill of joy and hope the people on the wreck beheld the boat dancing an the crested waves towards them; and how great must have been the surprise that mingled with their other feelings on observing that one of the rowers was a woman!

They gained the rock in safety; but here their danger was increased ten-fold, and it was only by the exertion of great muscular power, coupled with resolute courage, that they prevented the boat being dashed to pieces against the rock.

One by one the sufferers were got into the boat. Sarah Dawson was found lying in the fore-cabin with a spark of life still trembling in her bosom, and she still clasped her two little ones in her arms, but the spirits of both had fled to Him who gave them. With great difficulty the boat was rowed back to the Longstone, and the

rescued crew landed in safety. Here, owing to the violence of the sea, they were detained for nearly three days, along with a boat's crew which had put off to their relief from North Sunderland; and it required some ingenuity to accommodate so large a party within the narrow limits of a lighthouse. Grace gave up her bed to poor Mrs Dawson; most of the others rested as they best could upon the floor.

The romantic circumstances of this rescue, the isolated position of the girl, her youth and modesty, and the self-devoting heroism displayed upon this occasion, thrilled through the length and breadth of the country like an electric shock, and the name of Grace Darling became for the time as well known as that of the greatest in the land, while the lonely lighthouse on the Longstone became a point of attraction to thousands of warm admirers, among whom were many of the rich and the noble. Letters and gifts flowed in upon Grace Darling continually. The public seemed unable to do enough to testify their regard. The Duke of Northumberland invited her over to Alnwick Castle, and presented her with a gold watch. A public subscription, to the amount of 700 pounds, was raised for her. The Humane Society presented her with a handsome silver tea-pot and a vote of thanks for her courage and humanity. Portraits of her were sold in the print-shops all over the land; and the enthusiasm, which at first was the natural impulse of admiration for one who had performed a noble and heroic deed, at last rose to a species of mania, in the heat of which not a few absurdities were perpetrated.

Among others, several of the proprietors of the metropolitan theatres offered her a large sum nightly on condition that she would appear on the stage, merely to sit in a boat during the performance of a piece illustrative of the incident of which she was the heroine! As might have been expected of one whose spirit was truly noble, she promptly declined all such offers. God seems to have put his arm tenderly

round Grace Darling, and afforded her special strength to resist the severe temptations to which she was exposed.

All proposals to better her condition were rejected, and she returned to her home on the island rock, where she remained with her father and mother till within a few months of her death. The fell destroyer, alas! claimed her while yet in the bloom of womanhood. She died of consumption on the 20th of October 1842, leaving an example of self-devoting courage in the hour of danger, and self-denying heroism in the hour of temptation, that may well be admired and imitated by those whose duty it is to man the lifeboat and launch to the rescue on the stormy waves, in all time to come.

Lifeboats.

A lifeboat—that is to say, the lifeboat of the present time—differs from all other boats in four particulars. It is *almost* indestructible; it is insubmergible; it is self-righting; it is self-emptying. In other words, it can hardly be destroyed; it cannot be sunk; it rights itself if upset; it empties itself if filled.

The first of these qualities is due to the unusual strength of the lifeboat, not only in reference to the excellence of the materials with which it is made, but also to the manner in which the planks are laid on. These cross one another in a diagonal manner, which cannot be easily described or explained to ordinary readers; but it is sufficient to say that the method has the effect of binding the entire boat together in a way that renders it much stronger than any other species of craft. The second quality—that of insubmergibility—is due to air-chambers fixed round the sides of the boat, under the seats, and at the bow and stern. These air-cases are

sufficiently buoyant to float the boat even if she were filled to overflowing with water and crowded to her utmost capacity with human beings. In short, to use an expression which may appear paradoxical, she can carry more than she can hold—has floating power sufficient to support more than can be got into her. The third—her self-righting quality—is also due to air-chambers, in connection with a heavy keel. There are two large and prominent air-cases in the lifeboat—one in the bow, the other in the stern. These rise considerably above the gunwale, insomuch that when the boat is turned upside-down it rests upon them as upon two pivots. Of course it cannot remain stationary on them for a moment, but must necessarily fall over to the one side or the other. This is the first motion in self-righting; then the heavy keel comes into play, and pulls the boat quite round. Being full of water, the lifeboat would be comparatively useless but for its fourth quality—that of self-emptying. This is accomplished by means of six large holes which run through the floor and bottom of the boat. The floor referred to is air-tight, and is so placed that when fully manned and loaded with passengers it is a *very little above the level of the sea*. On this fact the acting of the principle depends. Between the floor and the bottom of the boat—a space of upwards of a foot in depth—there is some light ballast of cork or of wood, and some parts of the space are left empty. The six holes above-mentioned are tubes of six inches in diameter, which extend from the floor through the bottom of the boat. Now, it is one of nature's laws that water must find its level. For instance, take any boat and bore large holes in its bottom, and suppose it to be supported in its *ordinary* floating position, so that it cannot sink even though water runs freely into it through the holes. Then fill it suddenly quite full of water. Of course the water inside will be considerably above the level of the water outside, but it will continue to run out at the holes until it is exactly on a level with the water outside. Now, water poured into a lifeboat acts exactly in the same

way, but when it has reached the level of the water outside *it has also reached the floor*; so that there is no more water to run out.

Such are the principal qualities of the splendid lifeboat now used on our coasts, and of which it may be said that it has reached a state of almost absolute perfection.

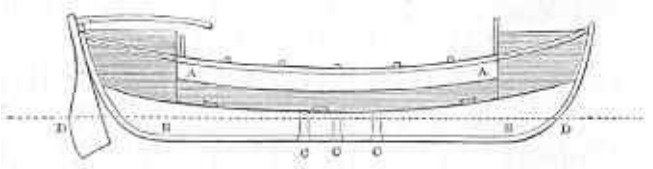


FIG. 1.—SIDE VIEW OF THE LIFEBOAT.

The accompanying sections of the lifeboat exhibit the position of the air-cases and discharging tubes. In Figure 1 the *shaded* parts give a side view of the air-cases. The line A A indicates the deck or floor, which lies a *little* above the level of the water when the boat is loaded; B B is the water-tight space containing ballast; C C C are three of the six discharging holes or tubes; the dotted line D D shows the level of the sea. Figure 2 gives a bird's-eye view of the boat. The shaded parts indicate the air-cases; and the position of the six discharging tubes is more clearly shown than in Figure 1. There are three covered openings in the floor, which permit of a free circulation of air when the boat is not in use, and in one of these is a small pump to clear the ballast-space of leakage. It will be observed that the boat draws little water; in fact, there is much more of her above than below water, and she is dependent for stability on her great breadth of beam and her heavy keel.

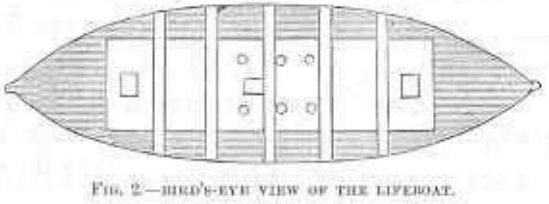


Fig. 2.—Bird's-eye view of the lifeboat.

These four qualities in the lifeboat are illustrated every year by many thrilling incidents of wreck and rescue. Let us glance at a few of these. First, then, as to the *almost* indestructible quality. Take the following evidence:—

On a terrible night in the year 1857 a Portuguese brig struck on the Goodwin Sands, not far from the lightship that marks the northern extremity of those fatal shoals. A shot was fired, and a rocket sent up from the lightship as a signal to the men on shore that a vessel had got upon the sands. No second signal was needed. Anxious eyes had been on the watch that night. Instantly the Ramsgate men jumped into their lifeboat, which lay alongside the pier. It was deadly work that had to be done,—the gale was one of the fiercest of the season,—nevertheless the gallant men were so eager to get into the boat that it was overmanned, and the last two who jumped in were obliged to go ashore. A small but powerful steamer is kept to attend upon this boat. In a few minutes it took her in tow and made for the mouth of the harbour.

They staggered out right in the teeth of tide and tempest, and ploughed their way through a heavy cross-sea that swept again and again over them, until they reached the edge of the Goodwins. Here the steamer cast off the boat, and waited for her, while she dashed into the surf and bore the brunt of the battle alone.

With difficulty the brig was found in the darkness. The lifeboat cast anchor when within about forty fathoms, and veered down under her lee. At first they were in hopes of getting the vessel off, and hours were spent in vain endeavours to do this. But the storm increased in fury; the brig began to break up; she rolled from side to side, and the yards swung wildly in the air. A blow from one of these yards would have stove the boat in, so the Portuguese crew—twelve men and a boy—were taken from the wreck, and the boatmen endeavoured to push off. All this time the boat had been floating in a basin worked in the sand by the motion of the wreck; but the tide had been falling, and when they tried to pull up to their anchor the boat struck heavily on the edge of this basin. The men worked to get off the shoals as only those can work whose lives depend on their efforts. They succeeded in getting afloat for a moment, but again struck and remained fast. Meanwhile the brig was lifted by each wave and let fall with a thundering crash; her timbers began to snap like pipe-stems, and as she worked nearer and nearer, it became evident that destruction was not far off.

LAUNCH OF A LIFE-BOAT. *Page 111.*

The heavy seas caused by the increasing storm flew over the lifeboat, so that those in her could only hold on to the thwarts for their lives. At last the brig came so near that there was a stir among the men; they were preparing for the last struggle—some of them intending to leap into the rigging of the wreck and take their chance; but the coxswain shouted, "Stick to the boat, boys! stick to the boat!" and the men obeyed.

At that moment the boat lifted a little on the surf, and grounded again. New hope was infused by this.

The men pulled at the hawser, and shoved might and main with the oars. They

succeeded in getting out of immediate danger, but still could not pull up to the anchor in teeth of wind and tide. The coxswain then saw plainly that there was but one resource left—to cut the cable and drive right across the Goodwin Sands. But there was not yet sufficient water on the Sands to float them over; so they held on, intending to ride at anchor until the tide, which had turned, should rise. Very soon, however, the anchor began to drag. This compelled them to hoist sail, cut the cable sooner than they had intended, and attempt to beat off the Sands. It was in vain. A moment more, and they struck with tremendous force. A breaker came rolling towards them, filled the boat, caught her up like a plaything on its crest, and, hurling her a few yards onwards, let her fall again with a shock that well-nigh tore every man out of her. Each successive breaker treated her in this way.

Those who dwell by the sea-shore know well the familiar ripples that mark the sands when the tide is out. On the Goodwins these ripples are gigantic steps, to be measured by feet, not by inches. From one to another of these banks this splendid boat was thrown. Each roaring surf caught it by the bow or stern, and, whirling it right round, sent it crashing on the next ledge. The Portuguese sailors appeared to give up all hope, and clung to the thwarts in silent despair; but the crew—eighteen in number—did not lose heart altogether. They knew their boat well, had often gone out to battle in her, and hoped that they might yet be saved if she should only escape striking on the pieces of old wrecks with which the Sands were strewn.

Thus, literally, yard by yard, with a succession of shocks that would have knocked any ordinary boat to pieces, did that lifeboat drive during *two* hours over *two* miles of the Goodwin Sands. At last they drove into deep water; the sails were set; and soon after, through God's mercy, they landed the rescued crew in safety in Ramsgate Harbour.

What further evidence need we that the lifeboat is almost, if not altogether, indestructible?

That the lifeboat is insubmergible has been proved to some extent by the foregoing incident. No better instance could be adduced to prove the buoyancy of the life boat than that of the Tynemouth boat, named the Constance, at the wreck of the *Stanley,* in the year 1864. In this case, while the boat was nearing the wreck, a billow broke over the bow of the *Stanley,* and falling into the Constance, absolutely overwhelmed her. Referring to this, the coxswain of the lifeboat says: "The sea fell over the bows of the Stanley and buried the lifeboat. Every oar was broken at the gunwale of the boat, and the outer ends swept away. The men made a grasp for the spare oars; three were gone—two only remained." Now, it is to be observed that the coxswain here speaks of the boat as being *buried, sunk* by the waves, and *immediately,* as he says, "the men made a grasp for the spare oars." The sinking and leaping to the surface seem to have been the work almost of the same moment. And this is indeed the case; for when the force that sinks a lifeboat is removed, she rises that instant to the surface like a cork.

In order to prove the value of the self-righting quality, and the superiority of those lifeboats which possess it over those which are destitute of it, we will briefly cite three cases—the last of which will also prove the value of the self-emptying quality.

On the 4th of January 1857, the Point of Ayr lifeboat, when under sail in a gale, upset at a distance from land. The accident was seen from the shore; but no help could be rendered, and the whole boat's crew—thirteen in number—were drowned. Now, this was deemed a good lifeboat, but it was not a self-righting one; and two of her crew were seen clinging to the keel for twenty minutes, by which

time they became exhausted and were washed off.

Take another case of a non-self-righting boat. In February 1858 the Southwold lifeboat, a large sailing-boat, and esteemed one of the finest in the kingdom, went out at the quarterly period of exercise in rough weather, and was running before a heavy sea with all sail set when she suddenly ran on the top of a wave, broached to, and upset. The crew in this case were fortunately near the land, had on their cork belts, and were dragged ashore, though with difficulty; but three amateurs, who were without belts, perished.

These two cases occurred in the day-time.

The third case happened at night—on a very dark stormy night in October 1858. A wreck had been seen about three miles off Dungeness, and the lifeboat at that place—a small self-righting and self-emptying one belonging to the Royal National Lifeboat Institution—put off, with eight stout men of the coast-guard for a crew. On reaching the wreck, soon after midnight, it was found that the crew had deserted her; the lifeboat therefore returned towards the shore. On nearing it she got into a channel between two shoals, where she was caught up and struck by three heavy seas in succession. The coxswain lost command of the rudder; she was carried away before the sea, broached to, and upset, throwing her crew out of her. Immediately she righted herself, cleared herself of water, and the anchor, having fallen out, brought her up. The crew, meanwhile, having on cork belts, floated, regained the boat, clambered into it by means of the life-lines hung round her sides, cut the cable, and returned to shore in safety.

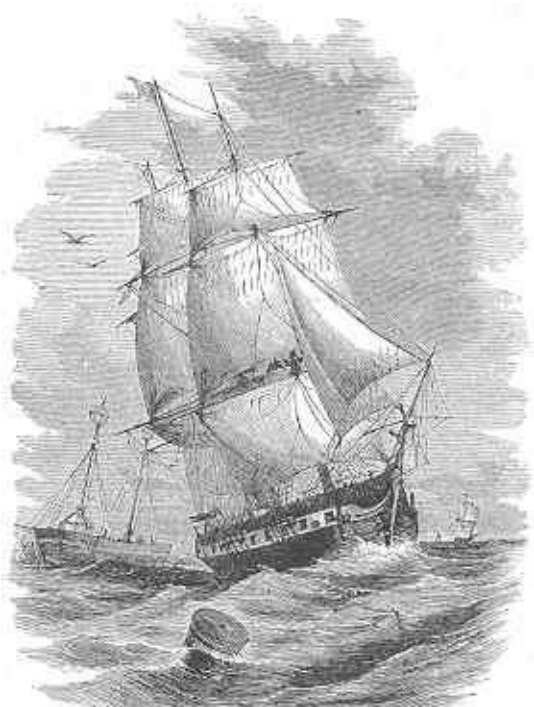
So much for the nature and capabilities of our lifeboats. We cannot afford space to

say more in regard to them than that they are the means, under God, of saving many hundreds of human lives every year on the coasts of the United Kingdom, besides a large amount of shipping and property, which, but for them, would inevitably be lost. The noble Institution which manages them was founded in 1824, and is supported entirely by voluntary contributions.

Along with the lifeboat we may appropriately describe here another species of vessel, which, if it does not directly rescue lives, at all events prevents disaster by giving timely warning of danger. We refer to:—

Lightships.

These floating beacons are anchored in the immediate vicinity of the numerous sand-banks which lie off the mouths of some of the principal ports of the kingdom, especially in England, and on other parts of our shores. There are numerous floating lights around our coasts, marking shoals on which lighthouses could not easily be erected. Their importance to shipping is inconceivably great. The accompanying illustration shows a vessel passing the lightship at the Nore.



VESSEL PASSING THE NORE LIGHTSHIP.

The impossibility of shipping getting safely into or out of the port of London without the guiding aid of lightships, as well as of buoys and beacons, may be made clear by a simple statement of the names of some of the obstructions which lie in the mouth of the Thames. There are the *Knock* Shoals, the East and West *Barrows*, the *John*, the *Sunk*, the *Girdler*, and the *Long* Sands, all lying like so many ground sharks waiting to arrest and swallow up passing vessels, which, unfortunately, they too often accomplish despite the numerous precautions taken to rob them of their prey. Most people know the appearance of buoys, but we dare say few have seen a buoy or beacon resembling the one in our engraving, which is a sort of cage, fastened to a buoy, with a bell inside that rings by the action of the waves. It must have been something of this

sort that was used at the famous "Bell Rock" in days of yore.

Lightships are usually clumsy-looking, red-painted vessels, having one strong mast amidships, with a ball at the top, about six feet in diameter, made of light laths. This ball is a very conspicuous object, and clearly indicates a lightship to the passing vessel during the day. At night a huge lantern traverses on, and is hoisted to nearly the top of, the same mast. It is lighted by a number of argand lamps with powerful reflectors. Some lightships have two masts, and some three, with a ball and a lantern on each. Some of these lanterns contain fixed, others revolving lights—these differences being for the purpose of indicating to seamen the particular light which they happen to be passing.

Thus, the Goodwin Sands, which are upwards of ten miles in length, are marked by three lightships. The one on the north has three masts and three *fixed* lights. The one on the south has two masts and two *fixed* lights. The one that lies between the two—off Ramsgate, and named the Gull—has one mast and one *revolving* light.

The crew

STEEPLE BUOY.
Page 131.

of a lightship consists of about nine or ten men, each of whom does duty for two months on board, and one month on shore, taking their turn by rotation; so that the number of men always on board is about seven. While on shore, they attend to the buoys, anchors, chain-cables, and other stores of the Trinity House, which has charge of all the lights, buoys, and beacons in England. They also assist in laying down new buoys and sinkers, and removing old ones, etcetera.

Lightships run considerable risk, for besides being exposed at all times to all the storms that rage on our shores, they are sometimes run into by ships in foggy weather.

The *Gull* lightship, above referred to, occupies a peculiar and interesting position. Being in the very centre of all the shipping which passes through the Downs, she

has frequent narrow escapes, and has several times been damaged by collisions. The marvel is that, considering her position, she does not oftener "come to grief." She also signals for the Ramsgate lifeboat, by means of guns and rockets, when a ship is observed by her crew to have got upon the dreaded Goodwin Sands.

We had the pleasure of spending a week on board of the *Gull* lightship not long ago, and one night witnessed a very stirring scene of calling out the lifeboat. We shall conclude this subject by quoting the following letter, which we wrote at the time, giving a detailed account of it.

Ramsgate, March 26, 1870.

The eye-witness of a battle from an unusual point of view may, without presumption, believe that he has something interesting to tell. I therefore send you an account of what I saw in the *Gull* lightship, off the Goodwin Sands, on the night of Thursday last, when the *Germania*, of Bremen, was wrecked on the South-Sand-Head. Having been an inhabitant of the *Gull* lightship for a week, and cut off from communication with the shore for several days, I have been unable to write sooner.

Our never-ending warfare with the storm is well known. Here is one specimen of the manner in which it is carried on.

A little before midnight on Thursday last (the 24th), while I was rolling uneasily in my "bunk," contending with sleep and sea-sickness, and moralising on the madness of those who choose "the sea" for a profession, I was roused—and sickness instantly cured—by the watch on deck suddenly shouting down the hatchway to the mate, "*South-Sand-Head* light is firing, sir, and sending up

rockets." The mate sprang from his "bunk," and was on the cabin floor before the sentence was well finished. I followed suit, and pulled on coat, nether garments, and shoes, as if my life depended on my own speed. There was unusual need for clothing, for the night was bitterly cold. A coat of ice had formed even on the salt-water spray which had blown into the boats. On gaining the deck, we found the two men on duty actively at work, the one loading the lee gun, the other adjusting a rocket to its stick. A few hurried questions from the mate elicited all that it was needful to know. The flash of a gun from the *South-Sand-Head* lightship, about six miles distant, had been seen, followed by a rocket, indicating that a vessel had got upon the fatal Goodwins. While the men spoke, I saw the bright flash of another gun, but heard no report, owing to the gale carrying the sound to leeward. A rocket followed, and at the same moment we observed the light of the vessel in distress just on the southern tail of the Sands. By this time our gun was charged, and the rocket in position. "Look alive, Jack! get the poker," cried the mate, as he primed the gun. Jack dived down the companion hatch, and in another moment returned with a red-hot poker, which the mate had thrust into the cabin fire at the first alarm. Jack applied it in quick succession to the gun and the rocket. A blinding flash and deafening crash were followed by the whiz of the rocket as it sprang with a magnificent curve far away into the surrounding darkness. This was our answer to the *South-Sand-Head* light, which, having fired three guns and three rockets to attract our attention, now ceased firing. It was also our note of warning to the look-out on the pier of Ramsgate Harbour. "That's a beauty," said our mate, referring to the rocket; "get up another, Jack; sponge her well out. Jacobs, we'll give 'em another shot in a few minutes." Loud and clear were both our signals; but four and a half miles of distance and a fresh gale neutralised their influence. The look-out did not see them. In less than five minutes the gun and rocket were fired again. Still

no answering signal came from Ramsgate. "Load the weather gun," said the mate. Jacobs obeyed; and I sought shelter under the lee of the weather bulwarks, for the wind appeared to be composed of pen-knives and needles. Our third gun thundered forth, and shook the lightship from stem to stern; but the rocket struck the rigging, and made a low, wavering flight. Another was therefore sent up; but it had scarcely cut its bright line across the sky, when we observed the answering signal—a rocket from Ramsgate Pier.

"That's all right now, sir; our work is done," said the mate, as he went below, and, divesting himself of his outer garments, quietly turned in; while the watch, having sponged out and re-covered the gun, resumed their active perambulation of the deck. I confess that I felt somewhat disappointed at this sudden termination of the noise and excitement. I was told that the Ramsgate lifeboat could not well be out in less than an hour. It seemed to my excited spirit a terrible thing that human lives should be kept so long in jeopardy; and, of course, I began to think, "Is it not possible to prevent this delay?" But excited spirits are not always the best judges of such matters, although they have an irresistible tendency to judge. There was nothing for it, however, but patience; so I turned in, "all standing," as sailors have it, with orders that I should be called when the lights of the tug should come in sight. It seemed but a few minutes after, when the voice of the watch was again heard shouting hastily, "Lifeboat close alongside, sir. Didn't see it till this moment. She carries no lights." I bounced out, and, minus coat, hat, and shoes, scrambled on deck, just in time to see the *Broadstairs* lifeboat rush past us before the gale. She was close under our stern, and rendered spectrally visible by the light of our lantern. "What are you firing for?" shouted the coxswain of the boat. "Ship on the sands, bearing south," replied Jack at the full pitch of his stentorian voice. The boat

did not pause. It passed with a magnificent rush into darkness. The reply had been heard; and the lifeboat shot straight as an arrow to the rescue. We often hear and read of such scenes, but vision is necessary to enable one to realise the full import of all that goes on. A strange thrill ran through me as I saw the familiar blue and white boat leaping over the foaming billows. Often had I seen it in model, and in quiescence in its boat-house—ponderous and ungainly; but now I saw it, for the first time, endued with life. So, I fancy, warriors might speak of our heavy cavalry as we see them in barracks, and as *they* saw them at Alma. Again all was silent and unexciting on board of the *Gull*. I went shivering below, with exalted notions of the courage and endurance of lifeboat men. Soon after, the watch once more shouted, "Tug's in sight, sir;" and once again the mate and I went on deck. On this occasion, the tug *Aid* had made a mistake. Some one on shore had reported that the guns and rockets had been seen flashing from the *Gull* and *North-Sand-Head* lightships; whereas the report should have been, from the *Gull* and *South-Sand-Head* vessels. The single word was all-important. It involved an unnecessary run of about twelve miles, and an hour and a half's loss of time. But we mention this merely as a fact, not as a complaint. Accidents will happen. The Ramsgate lifeboat service is admirably regulated, and for once that an error of this kind can be pointed out, we can point to dozens—ay, hundreds—of cases in which the steamer and lifeboat have gone straight as the crow flies to the rescue, and have done good service on occasions when all other lifeboats would have failed, so great is the value of steam in such matters. On this occasion, however, the tug appeared late on the scene, and hailed us. When the true state of the case was ascertained, the course was directed aright, and full steam let on. The Ramsgate lifeboat, *Bradford*, was in tow far astern. As she passed us the brief questions and answers were repeated for the benefit of the coxswain of the boat. I observed that every man in the boat lay flat

on the thwarts except the coxswain. No wonder. It is not an easy matter to sit up in a gale of wind, with freezing spray, and sometimes green seas, sweeping over one. They were, doubtless, wide awake, and listening; but, as far as vision went, that boat was manned with ten oilskin coats and sou'-westers. A few seconds took them out of sight; and thus, as far as the *Gull* lightship was concerned, the drama ended. There was no possibility of our ascertaining more, at least during that night; for whatever might be the result of these efforts, the floating lights had no chance of hearing of them until the next visit of their tender. I was therefore obliged to turn in once more, at three a.m. Next forenoon we saw the wreck, bottom up, high on the Goodwin Sands.

On Friday morning, the *Alert*—tender to the lightships of this district, under command of the Trinity Superintendent, Captain Vaile—came off to us, and we learned the name of the vessel, that she was a total wreck, and that the crew, seven men, had taken to their boat, and succeeded in reaching the *South-Sand-Head* lightship, whence they were almost immediately after taken by the Deal lifeboat, and safely landed at Deal.

It is to be carefully observed here that, although in this case much energy was expended unnecessarily, it does not follow that it is often so expended. Often—too often—all the force of lifeboat service on this coast is insufficient to meet the demands on it. The crews of the various boats in the vicinity of the Goodwin Sands are frequently called out more than once in a night; and they are sometimes out all night, visiting various wrecks in succession. In all this work the value of the steam-tug is very conspicuous. For it can tow its boat again and again to windward, and renew the effort to save life in cases where, unaided, lifeboats would be compelled to give in. Embarking in the *Alert*, I sailed round the wreck at low water, and

observed that the Deal luggers were swarming round her like flies; the crews stripping her bottom of copper, and saving her stores, while, apparently, hundreds of men were busy upon her deck dismantling her shattered hull.

This, after all, is but an insignificant episode of wreck on the Goodwins. Many wrecks there are every year much more worthy of record; but this is sufficient to give a general idea of the manner in which our great war with the storm is conducted—the promptitude with which relief is rendered, and the energy with which our brave seamen are ready to imperil their lives almost every night, all round the coast, and all the year round.

Chapter Eight.

Docks and Shipbuilding.

Having in the previous chapters treated of the subjects of ancient navigation and ships, and given some account of the boats of the present time, we now proceed to write about modern ships. In doing so, let us turn our attention first to:—

The Dockyard.

If we were a maker of riddles, we would ask our reader, "Why is a ship like a human being?" and having added, "D'ye give it up?" would reply, "Because it commences life in a cradle;" but not being a fabricator of riddles, we *don't* ask our reader that question. We merely draw his attention to the fact that ships, like men,

have not only an infancy, but also have cradles—of which more hereafter.

Let us enter one of those naval nurseries—the dockyard—where ships may be seen commencing their career. What a scene it is! What sawing and thumping, and filing, and grinding, and clinching, and hammering, without intermission, from morn till noon, and from noon till dewy eve! What a Babel of sounds and chaos of indescribable material!

That little boy whom you observe standing under the shadow of yonder hull—his hands in his pockets (of course), his mouth open (probably), and his eyes gazing up fixedly at the workmen, who cluster like bees on the ribs and timbers of yonder infant ship has stood there for more than an hour, and he will stand there, or thereabout, for many hours to come; for it happens to be a holiday with him, and he dotes on harbours and dockyards. His whole being is wrapped up in them.

And this is natural enough. Most boys delight to gaze on incomprehensible and stupendous works. Let us—you and I, reader—follow this urchin's example, keeping our mouths shut, however, save when we mean to speak, and our eyes open.

There are ships here of every shape and size—from the little coasting-vessel to the great East Indiaman, which, in its unfinished condition, looks like the skeleton of some dire megatherium of the antediluvian world. Some of these infant ships have an enormous shed over them to protect them from the weather; others are destitute of such protection: for ships, like men, it would seem, are liable to vicissitudes of fortune. While the "great ones" of the dockyard world are comfortably housed, the small ones are not unfrequently exposed to the fitful buffeting of the rude elements even from their birth.

There are ships here, too, in every state of progression. There, just beside you, is a "little one" that was born yesterday. The keel has just been laid on the blocks; and it will take many a long day of clinching and sawing and hammering ere that infant assumes the bristling appearance of an antediluvian skeleton. Yonder is the hull of a ship almost completed. It is a gigantic infant, and has the aspect of a very thriving child. It evidently has a robust constitution and a sturdy frame. Perhaps we may re-visit the dockyard to-morrow, and see this vessel launched.

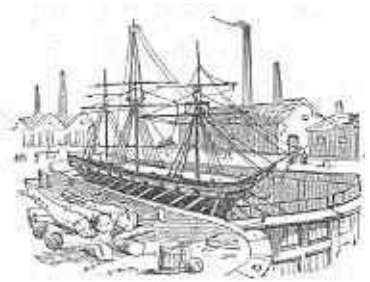
Besides these two, there are ships with their ribs partially up, and ships with their planking partially on; and in a more distant part of the yard there are one or two old ships hauled up, high and dry, to have their bottoms repaired and their seams re-pitched, after many a rough and bravely-fought battle with the ocean waves.

Now that we have gazed our fill at the general aspect of the dockyard, let us descend a little more to particulars. We shall first tell of the:—

Nature and Use of Docks.

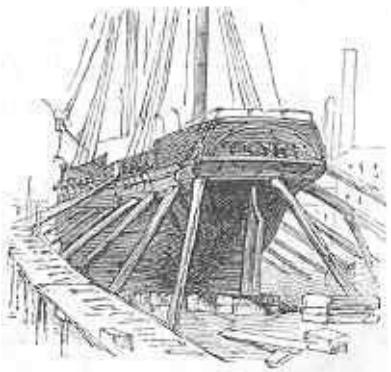
There are two kinds of docks—dry and wet. A dry-dock is usually constructed with gates, to admit or shut out the tide. When a ship arrives from a long voyage, and needs repair to the lower part of her hull, she must be got out of the water somehow or other.

This object is frequently attained in regard to small vessels by simply running them gently on the flat sand or mud beach of a bay or harbour, so that, when the tide



DRY-DOCK.

retires, they shall be left dry. But it would be dangerous as well as inconvenient to do this with large ships, therefore dry-docks have been constructed for this purpose. They are so built that when the tide is full the dry-docks are also full. When thus full of water, the gates of a dry-dock are opened, and the large ship is dragged slowly in, after which the gates are shut. The tide then retires, leaving it in this basin of water. The ship is then propped up on all sides with timbers, in such a way that she stands upright, "upon an even keel," and thus, the pressure on her hull being equally distributed, she is not damaged.



SHIP PROPPED OR "SHORED-UP" IN DOCK.

Then the water is let out by means of sluices in the gates, or it is pumped out, and the ship left dry. When the tide returns, the gates and sluices are all shut, and its entrance into the dock prevented, until such time as the ship is repaired, when water is let slowly in. As the vessel floats, the

props and supports fall away, the gates of her hospital are opened, and off she goes again, in all the vigour of recruited health, to wing her way over the billows of the great deep.

A wet-dock is somewhat similar to a dry-dock, the chief difference being that ships while in it are kept floating in water.

Docks are not only used, however, for repairing and building ships. They are also used for loading and unloading them; and as ships are entering and departing from them almost constantly, the busy, bustling, active scene they present is always agreeable.

The principal docks in the United Kingdom are as follows:—

ONE OF THE LONDON DOCKS.

Docks on the Thames—namely, East and West India Docks, London Docks, Saint Katherine's Docks, Commercial Docks, Victoria Docks.

Southampton Docks.

Liverpool and Bristol Docks.

Hull Docks.

Glasgow Docks.

Dundee Docks.

Leith Docks.

Birkenhead Docks.

So much for docks in passing. Let us now turn our attention to the process of:—

Building a Ship.

As we think it highly improbable that any of our readers intend to become either ship-carpenters or ship-architects, we will not worry them with technical explanations. To give an easily understood and general idea of the manner of building a ship is all we shall attempt. The names of those parts only that are frequently or occasionally referred to in general literature shall be given.

The term *ship* is employed in two significations. In familiar language it denotes any large or small vessel that navigates the ocean with sails. In nautical language it refers solely to a vessel having three masts, each consisting of a lower-mast, a top-mast, and a top-gallant-mast. At present we use the term *ship* in the familiar sense.

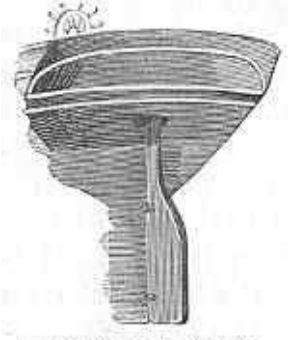
Elaborate and complicated drawings having been prepared, the shipbuilder begins his work.

The *keel* is the first part of a ship that is laid. It is the beam which runs along the bottom of a boat or ship from one end to the other. In large ships the keel consists of several pieces joined together. Its uses are, to cause the ship to preserve a direct course in its passage through the water; to check the leeway which every

vessel has a tendency to make; and to moderate the rolling motion. The keel is also the ground-work, or foundation, on which the whole superstructure is reared, and is, therefore, immensely strong and solid. The best wood for keels is teak, as it is not liable to split.

Having laid the keel firmly on a bed of wooden blocks, in such a position that the ship when finished may slide into the water stern foremost, the shipbuilder proceeds next to erect the stem and stern posts.

The *stem-post* rises from the *front* end of the keel, not quite perpendicularly from it, but sloping a little outwards. It is formed of one or more pieces of wood, according to the size of the ship; but no matter how many pieces may be used, it is always a uniform single beam in appearance. To this the ends of the planks of the ship are afterwards fastened. Its outer edge is called the *cut-water*, and the part of the ship around it is named the *bow*.



STERN OF VESSEL, SHOWING RUDDER.

The *stern-post* rises from the opposite end of the keel, and also slopes a little outwards. To it are fastened the ends of the planking and the framework of the

stern part of the ship. To it also is attached that little but most important part of a vessel, the *rudder*. The rudder, or helm, is a small piece of timber extending along the back of the stern-post, and hung movably upon it by means of what may be called large iron hooks-and-eyes. By means of the rudder the mariner guides the ship in whatever direction he pleases. The contrast between the insignificant size of the rudder and its immense importance is very striking. Its power over the ship is thus referred to in Scripture,—"Behold also the ships, which, though they be so great, and are driven of fierce winds, yet are they turned about with a very small helm, whithersoever the governor listeth." The rudder is moved from side to side by a huge handle or lever on deck, called the *tiller*; but as in large ships the rudder is difficult to move by so simple a contrivance, several ropes or chains and pulleys are attached to it, and connected with the drum of a *wheel*, at which the steersman stands. In the largest ships two, and in rough weather four men are often stationed at the wheel.

The *ribs* of the ship next rise to view. These are curved wooden beams, which rise on each side of the keel, and are bolted firmly to it. They serve the same purpose to a ship that bones do to the human frame—they support and give strength to it as well as form.

The *planks* follow the ribs. These are broad, and vary in thickness from two to four inches. They form the outer skin of the ship, and are fastened to the ribs, keel, stem-post, and stern-post by means of innumerable pins of wood or iron, called

CALKING SEAMS OF SHIP'S SIDE.

tree-nails. The spaces between the planks are caulked —that is, *stuffed* with oakum; which substance is simply the untwisted tow of old and tarry ropes. A figure-head of some ornamental kind having been placed on the top and front of the stem-post, just above the cutwater, and a flat, ornamental stern, with windows in it to light the cabin, the hull of our ship is complete. But the interior arrangements have yet to be described, although, of course, they have been progressing at the same time with the rest.

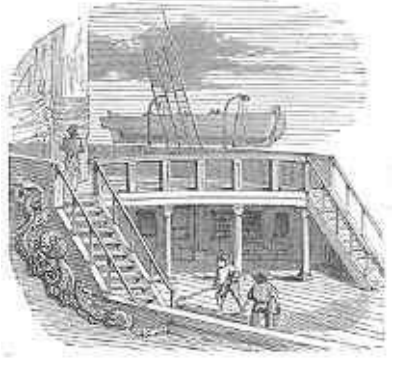
STERN OF SHIP.

The *beams* of a ship are massive wooden timbers, which extend across from side to side in a series of tiers. They serve the purpose of binding the sides together, of preventing them from collapsing, and of supporting the decks, as well as of giving

compactness and great strength to the whole structure.

The *decks* are simply plank floors nailed to the beams, and serve very much the same purposes as the floors of a house. They also help to strengthen the ship longitudinally. All ships have at least one complete deck; most have two, with a half-deck at the stern, called the *quarter-deck*, and another at the bow, called the *forecastle*. But the decks of large ships are still more numerous. Those of a first-rate man-of-war are as follows—we begin with the lowest, which is considerably under the surface of the sea:—

The Orlop-deck, the Gun-deck, the Middle-deck, the Upper-deck, the Quarter-deck, and the Poop—the latter deck being the highest deck of all, a very small one, at the stern.



THE QUARTER-DECK.

Thus a man-of-war is a floating house with six stories—the poop being the garret, and the orlop-deck the cellars. The upper decks are lighted by sky-lights; those farther down by port-holes (or gun-holes) and windows; the lowest of all by candles or lamps, daylight being for ever banished from those gloomy submarine

regions!

The *bulwarks* rise above the upper-deck, all round the ship, and serve the purposes of protecting the upper-deck from the waves, and supporting the *belaying-pins*, to which the ropes are fastened. In ships of war the top of the bulwarks forms a sort of trough all round the ship, in which the hammocks (the swinging-beds) of the men are stowed away every morning. This trough is termed the *hammock-nettings*, and the hammocks are placed there to be well aired. In action the bulwarks serve to protect the crew from musketry.

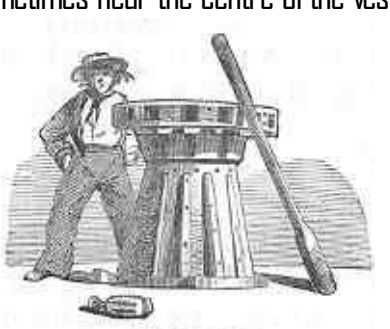
THE WHEEL.

The *wheel*, which has been already referred to, stands usually at the stern of the ship, on the quarter-deck; but it is sometimes placed on an elevated platform amid-ships, so that the steersman may see more clearly where he is going.

The *binnacle* stands directly in front of the wheel. It is a species of box, firmly fixed to the deck, in which is placed the compass. It is completely covered in, having a glass window, through which the man at the wheel can observe the course he is

steering.

The *capstan* stands on the main-deck, sometimes near the centre of the vessel, at



THE CAPSTAN.

other times near the bow or the stern. It is a massive block of timber moving on a pivot, which is turned round by wooden levers, called capstan bars, or *hand-spikes*; and is used for any purpose that requires great *tractive* power—the drawing in of the cable, for instance, or warping the ship; which means that a rope is fixed on shore, or by an anchor to the bottom of the sea, and the other end of it is coiled round the capstan, so that when the capstan is forced round by the handspikes, the rope coils on to it, and the ship is slowly dragged forward.

THE WINDLASS.

The *windlass* is simply a horizontal, instead of a perpendicular capstan. Its sole purpose is for heaving up the anchor, and it is placed close to the bow of the ship.

The *galley*, or cooking-house, is usually near to the windlass, in the front part of the vessel. Here the cook reigns supreme; but this nautical kitchen is wonderfully small. It is just big enough to hold the fireplace and "coppers," with a small shelf, on which the cook (always a man, and often a negro) performs the duties of his office.

The various decks below are partitioned off by means of plank walls, which are called *bulk-heads*, into a variety of berths and apartments; and the greater part of the centre of the vessel (in merchantmen) is called the *hold*, and is reserved for cargo.

The *hull* of the ship being finished, now gets a coat of tar all over it, which preserves the wood from the action of the weather, and helps to render the seams water-tight. Some vessels are sheathed from the keel to a short way above their water-line with thin sheets of copper, to preserve them more effectually from tear and wear, and especially to defend them against those barnacles and marine insects that would otherwise fasten to them.

Being now ready to be launched from her cradle into the sea—her future home—we will proceed in our next chapter to describe the process of launching.

Chapter Nine.

The Launch, etcetera.

Ships begin life with a retrograde movement; they imitate the crabs: in other words, they are launched stern foremost. Whether great or small, long or short, whether clothed in patrician copper or smeared with plebeian tar, they all start on their first voyage with their stern-posts acting the part of cut-water, and, also, without masts or sails. These necessary adjuncts, and a host of others, are added after they have been clasped to the bosom of their native sea. One notable exception there is to this rule, the launch of the far-famed *Great Eastern*, which monster of the deep was forced into her element *sidewise*, of which a full account will be found in another part of this volume.

The *cradles* on which ships are launched are wooden frameworks, so constructed as to slide down an inclined plane, called the *ways*, bearing their burdens along with them into the water. When a ship is ready for launching, the *shores*, or supports, that have kept her so long in position are knocked away one by one, until the entire weight of the ship rests on the cradle. The *ways* are then well greased, and it only remains to knock away one or two remaining checks to allow the vessel to seek her future home by means of her own weight.

But before this last act is done, a day must be fixed for the launch; friends of the owners must be invited to go on board during this her first voyage; a fair maiden must be asked to go through the ceremony of giving the ship her name; and paragraphs must go the round of the newspapers. As the hour draws near, crowds of human beings, young and old, male and female, must hurry to the spot to

witness the great event, and hundreds of little boys must beg leave from school (if they can); in short, a great stir must be made, and a great day must dawn, before the last shores are knocked away, and the noble structure be permitted to rush down that inclined plane, and for the first time cleave the waves.

And now, having shown how the launching of our ship is accomplished, let us turn to consider the next step towards completion; for there is yet much to be done ere she is able to brave the tempest.

Rigging a Ship.

Although fitting-in the lower-masts of a ship cannot well be deemed a part of the rigging, we will nevertheless describe the operation here.

As the lower-masts of a large ship are from five to six feet in circumference, it is manifest that some powerful mechanical contrivance is required to raise them over the bulwarks, and put them in an upright position, into their appointed places. Such contrivances, in the form of enormous cranes, are fixed in some of the larger docks; but the most useful method is to have the masts put in by means of:

The Shear Hulk. This is a strongly built hull of a ship, moored in a part of a river or harbour that will afford depth of water to float vessels of any size alongside. It has one stout mast, with two immense beams attached to it near the deck, and sloping outwards over the bulwarks in such a way that their ends overhang the deck of the vessel into which masts are to be placed. These sloping beams are prevented from falling overboard altogether, and their slope is regulated, by blocks and tackles from the mast of the hulk. By means of this contrivance, which is just a gigantic

floating crane, the ponderous lower-masts of large ships are raised and lowered into their places.

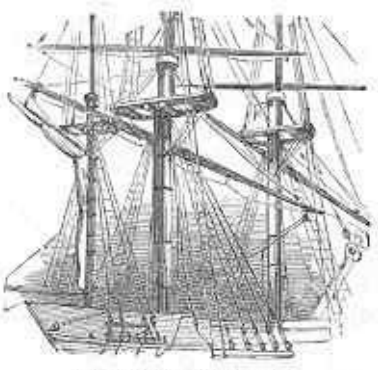
When these are fixed, the rigging of the ship commences. The method of putting it up cannot prove interesting to general readers; not even to boys, for when they take to rigging model ships, they do not require the mechanical contrivances that are necessary in rigging large vessels. But all readers of sea stories and nautical history will find it of the utmost advantage to their clear understanding of what they read, to have a general idea of the names and uses of the principal parts of a ship's rigging.

We shall, therefore, devote a small space to the explanation of this subject. And, first, let us examine the *Masts*.

These vary in size, form, and number in different ships, but in all they serve the same purpose—to support the sails. Lower masts of large vessels are never formed out of one tree. They are found to be stronger when built up of several pieces, which are fastened together by strong iron hoops. Masts sometimes consist of three distinct parts. The *lower*-mast, *top*-mast, and *top-gallant*-mast. In most large ships there are three masts, each having three parts. The centre mast, being the largest, is the *main-mast*; the front one, which is next in size, is the *fore-mast*; and the one next the stern, the smallest, is called the *mizzen*.

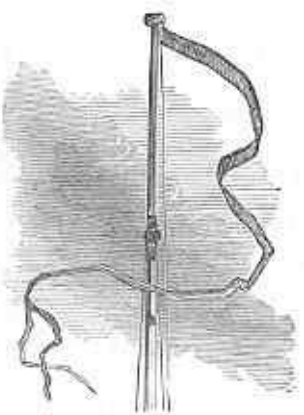
Although we have spoken of *lower-masts* for the sake of clearness, the name is never used. The name of the mast itself designates the lower part of it. To name the masts in order, we have the Fore-mast. Main-mast. Mizzen-mast. Fore-top-mast. Main-top-mast. Mizzen-top-mast. Fore-topgallant-mast. Main-topgallant-mast.

Mizzen-topgallant-mast.



LOWER MASTS AND "TOPS."

The parts of the different masts are connected and secured by means of *cross-trees* and *caps*, which are named after the mast and part of the mast to which they belong. Thus we have the *fore-top*, the *fore-top-mast cross-trees*, the *main-top*, and *main-top-mast cross-trees*, etcetera. Observe, particularly, that the *fore-top*, *main-top*, and *mizzen-top*, are the platforms, or cross-trees, at the tops of the *lower*-masts, and not—as might well be supposed by landsmen—the extreme tops



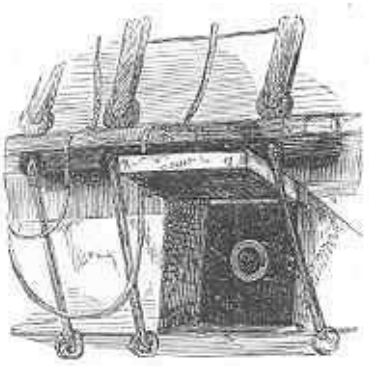
THE TRUCK.

of these masts. The button-like objects on the

summits of the masts are called the *trucks*; which, besides forming a sort of finish to them, are fitted with small *pulleys*; through which *signal-halyards*; or cords for hoisting the flags, are rove.

In first-rate men-of-war the *tops* are so large that a number of men can be stationed on them. Besides their other purposes, they are very frequently used as a place of punishment for the midshipmen, or "middies" (the boy officers), who are often sent there to air themselves, and profit, if they can, by calm reflection in exalted solitude.

Shrouds and *stays* are the thick ropes that keep the masts firmly in position. They form part of what is termed the "standing gear" of a ship—in other words, the ropes that are fixtures—to distinguish them from the "running gear"—those movable ropes, by means of which the sails, boats, flags, etcetera, are hoisted. Nearly all the ropes of a ship are named after the mast, or yard, or sail with which they are connected. Thus we have the *main shrouds*; the *main-top-mast shrouds*; and the *main-topgallant shrouds*; the *main back-stay*; the *main-topgallant back-stay*; and so on—those of the other masts being similarly named, with the exception of the first word, which, of course, indicates the particular mast referred



THE CHAINS.

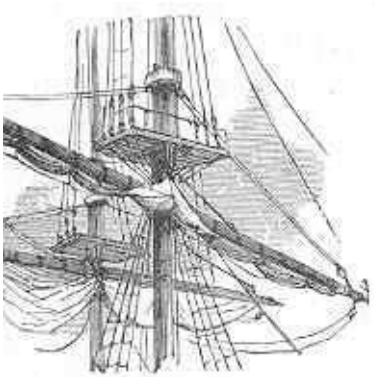
to. The shrouds rise from the *chains*, which are a series of blocks called "dead eyes," fixed to the sides of the ship. To these the shrouds are fixed, and also to the masts near the tops; they serve the purpose of preventing the masts from falling *sideways*. Backstays prevent them from falling *forward*, and *forestays* prevent them from falling *backward*, or "aft." Besides this, shrouds have little cross ropes called *ratlines* attached to them, by means of which rope-ladders the sailors ascend and descend the rigging to *furl*, that is, tie up, or *unfurl*, that is, to untie or shake out, the sails.

SHROUDS AND RATLINES.

Our cut represents a sailor-boy ascending the mizzen-top-mast shrouds. He grasps the *shrouds*, and stands on the *ratlines*.

Yards are the heavy wooden cross-poles or beams to which the sails are attached.

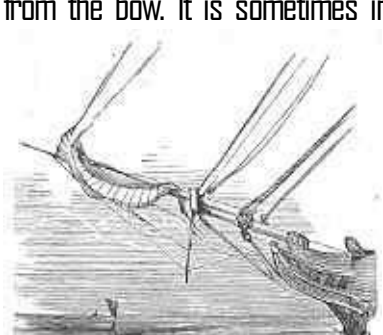
Reef-points are the little ropes which may be observed hanging in successive rows on all sails, by means of which *parts* of the sails are gathered in and tied round the yards, thus reducing their size in stormy weather. Hence such nautical expressions as "taking in a reef," or a "double reef," and "close reefing,"—which last implies that a sail is to be reduced to its smallest possible dimensions. The only further reduction possible would be folding it up altogether, close to the yard, which would be called "furling" it, and which would render it altogether ineffective.



YARD WITH SAIL FURLED.

In order to furl or reef sails, the men have to ascend the masts, and *lay-out* upon the yards. It is very dangerous work in stormy weather. Many a poor fellow, while reefing sails in a dark tempestuous night, has been blown from the yard into the sea, and never heard of more. All the yards of a ship, except the three largest, can be hoisted and lowered by means of *halyards*. The top-gallant masts can also be lowered, but the lower-masts, of course, are fixtures.

The *bowsprit* of a ship is a mast which projects out horizontally, or at an angle, from the bow. It is sometimes in two or three pieces, sometimes only in one.

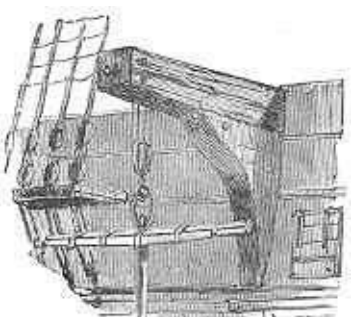


BOWSPRIT.

To it are attached the *jib-sail* and the *flying-jib*,

besides a variety of ropes and stays which are connected with and support the fore-mast.

The *cat heads* are two short beams which project from the bows on either side, and support the ship's anchors.



CAT HEAD.

Miscellaneous.—The openings in the decks are called *hatches*; the stair-cases which descend to the cabins are called *companions*. The pulleys by which sails, etcetera, are hoisted, are named *blocks*. *Braces* are the ropes by which sails are fixed tightly in any position. Hauling a rope *taut*, means hauling it tight. The *weather* side of a ship means the side which happens to be presented to the wind; the *lee* side, that which is away from the wind, and, therefore, sheltered. The *starboard* side means the right side, the *larboard* signifies the left; but as the two words resemble each other, the word *port* is always used for larboard to prevent mistakes in shouting orders. *Heaving the lead* is the act of throwing a heavy leaden plummet, with a line attached, into the sea to ascertain its depth. It is thrown from the *chains* as far as possible ahead of the ship, so that it may reach the bottom and be perpendicularly beneath the man who heaves it when the ship comes up to

the spot where it entered the water. A peculiar and musical cry is given forth by the heaver of the lead each time he throws it. The forecastle is the habitat of the ordinary sailors, and is usually in nautical parlance termed the *foge-s'l*.

THE MAIN HATCH.

Most of what we have just described applies more or less to every ship; but this will be seen in future chapters. Meanwhile, we would seriously recommend all those who have found this chapter a dry one to turn back to the heading entitled "Rigging a Ship," and from that point read it all over again with earnest attention.

Chapter Ten.

Coasting Vessels.

The coasting-trade of the British Islands is replete with danger, yet it is carried on with the utmost vigour; and there are always plenty of "hands," as seamen are called when spoken of in connection with ships, to man the vessels. The traffic in which they are engaged is the transporting of the goods peculiar to one part of our

island, to another part where they are in demand.

In describing these vessels, we shall begin with the smallest.

Sloops.

Like all other vessels, sloops vary in size, but none of them attain to great magnitude. As a class, they are the smallest decked vessels we have. From 40 to 100 tons burden is a very common size. A sloop of 40 tons burden is what we ordinarily call a *little* ship, and one of 100 tons is by no means a big one. The hull of such a vessel being intended exclusively to carry cargo, very little space is allowed for the crew.

SLOOP.

The cabins of the smaller-sized sloops are seldom high enough to permit of an ordinary man standing erect. They are usually capable of affording accommodation to two in the cabin, and three or four in the forecastle,—and such accommodation is by no means ample. The class to which vessels belong is determined chiefly by the number of their masts and by the arrangement and the form of their sails.

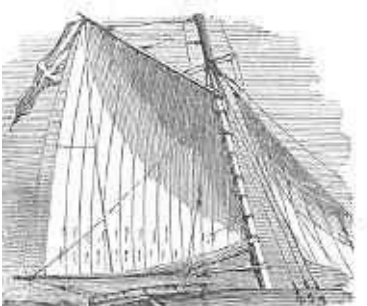
The distinctive peculiarity of the sloop is, that it has but one mast; and its rig is,

nautically speaking, *fore-and-aft*—that is to say, the sails are spread with their surfaces parallel to the sides of the vessel, *not* stretched upon yards *across* the vessel. The term "fore-and-aft" is derived from the *forward* part and the *after* part of the ship. *Fore-and-aft* sails, then, are such as are spread upon yards which point fore and aft, not across the ship. We conceive this elaborate explanation to be necessary for some readers, and, therefore, don't apologise for making it. A ship

SLOOP WITH SQUARE SAIL.

whose sails are spread across the hull is said to be *square-rigged*. Sometimes, however, a sloop carries one and even two square sails.

The masts, yards, and sails of a sloop are as follows:— As has been already said, one of the distinctive peculiarities of a sloop is, that it has only *one* mast. This mast is sometimes formed of one *stick*, sometimes of two; the second, or top-mast, being fastened to the top of the lower mast by *cross-trees* and *cap*, in such a way

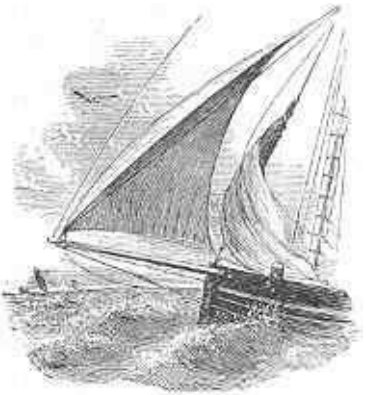


SLOOP'S MAIN-SAIL.

that it may be hoisted or lowered at pleasure. A sloop has usually four sails,—a mainsail, fore-sail, gaff, and jib. The *main-sail* is behind the lower mast. It reaches from within a few feet of the deck to the top of the lower mast, and spreads out upon two yards towards the stern or after part of

BOOM OF A SLOOP.

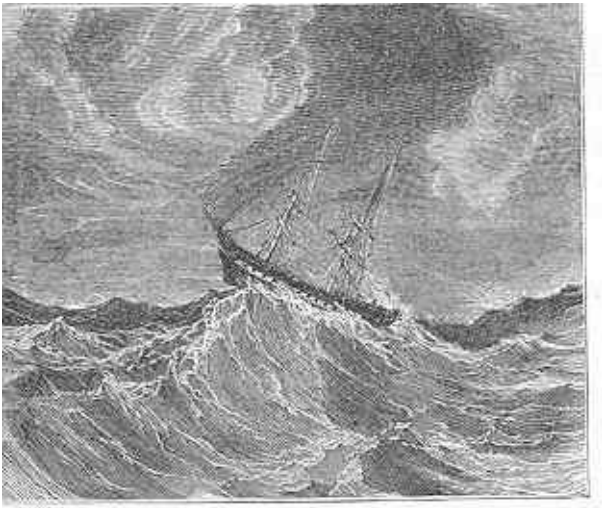
the ship, over which it projects a few feet. The lower yard of the main-sail is called the boom, and the upper the main-sail yard. This is by far the largest sail in the sloop. Above it is spread the *gaff*, which is comparatively a small sail, and is used when the wind is not very strong. The *fore-sail* is a triangular sheet, which traverses on the *fore-stay*, that is, the strong rope which runs from the lower mast-head to the bow, or front part of the sloop. On the bowsprit is stretched the *jib*, another triangular sail, which reaches nearly to the



JIB AND FORE-SAIL OF A SLOOP.

top of the lower mast. The only sail that rises above the lower mast is the gaff. In stormy weather this sail is always taken down. If the wind increases to a gale, the jib is lowered and lashed to the bowsprit.

Should the gale increase, a reef is taken in the main-sail. One, two, three, and sometimes four reefs are taken in, according to the violence of the storm; when the last reef is taken in, the sloop is under *close-reefed* main-sail. Increased violence in the storm necessitates the taking in of the main-sail and *lying-to* under the fore-sail, or a part of it. Lying-to is putting the sloop's head to the wind, and placing the helm in such a position that it tends to turn the vessel in one direction, while the gale acting on the fore-sail tends to force it in another, and thus it remains stationary between the two opposing forces. Many vessels thus *lie-to*, and



SCUDDING UNDER BARE POLES.

ride out the severest storm.

Sometimes, however, a dreadful hurricane arises, and compels vessels to take in all sails and "*scud under bare poles*"—that is, *drive before* the wind without any sails at all; and it is at such seasons that man is forced to feel his utter helplessness, and his absolute dependence on the Almighty. Of course, there are slight variations in the rig of sloops—some have a *square-sail*, and some have a *flying-jib*, but these are not distinctive sails, and they are seldom used in small craft.

Doubtless, those of our readers who have dwelt on the sea-coast must have observed that boats and vessels frequently sail in precisely opposite directions, although acted upon by the same wind. This apparent paradox may be explained thus:—

Suppose a vessel with the bow and stern sharp and precisely alike, so that it might sail backwards or forwards with equal facility. Suppose, also, that it has two masts

exactly the same in all respects—one near the bow, the other near the stern. Suppose, further, a square sail stretched between the two masts quite flat; and remember that this would be a *fore-and-aft* sail—namely, one extending along the length, not across the breadth of the vessel.

Well, now, were a breeze to blow straight against the side of such a vessel, it would either blow it over, flat on its side, or urge it slowly *sideways* over the water, after the fashion of a crab. Now remove one of these masts—say the stern one—and erect it close to the lee-side of the vessel (that is, away from the windward-side), still keeping the sail extended. The immediate effect would be that the sail would no longer present itself *flatly* against the wind, but diagonally. The wind, therefore, after dashing against it would slide violently off in the direction of the mast that had been removed, that is, towards the stern. In doing so it would, of course, give the vessel a shove in the opposite direction; on the very same principle that a boy, when he jumps violently off a chair, not only sends his body in one direction, but sends the chair in the opposite direction. So, when the wind jumps off the sail towards the stern, it sends the ship in the opposite direction—namely, forward. Reverse this; bring back the mast you removed to its old place in the centre of the deck, and shift the *front* mast near to the lee-bulwarks. The wind will now slide off the sail towards the *bow*, and force our vessel in the opposite direction—namely, backward; so that, with the same side wind, two ships may sail in exactly opposite directions.

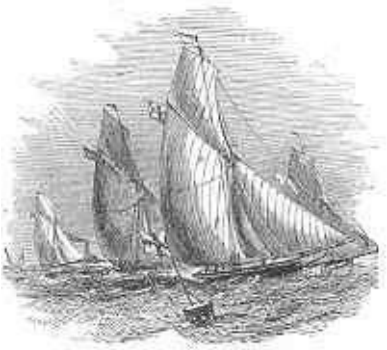
By means of the rudder, and placing the sails in various positions, so as to cause them to press against the masts in a particular manner, vessels can be made to sail not only with a side wind, but with a breeze blowing a good deal *against* them—in nautical phraseology, they can be made to sail "close to the wind." In short, they

can sail in every direction, except directly in the "teeth" of the wind. Some ships sail closer to the wind than others; their powers in this respect depending very much on the cut of their sails and the form of their hulls.

The *Lighter* is a small, rough, clumsy species of coasting-vessel, usually of the sloop rig. It is used for discharging cargoes of large vessels in harbours, and off coasts where the depth of water is not great. Lighters are usually picturesque-looking craft with dingy sails, and they seldom carry top-sails of any kind. Being seldom decked, they are more properly huge boats than little ships. But lighters are not classed according to their rig,—they may be of any rig, though that of the sloop is most commonly adopted.

The Cutter.

This species of vessel is similar, in nearly all respects, to the sloop; the only difference being that it is better and more elegantly built. Gentlemen's pleasure yachts are frequently cutters; but yachts may be of any form or rig—that is, they may belong to any *class* of vessels without changing their name of *yacht*. Cutter-yachts are much more elegantly moulded and rigged than the sloops that we have

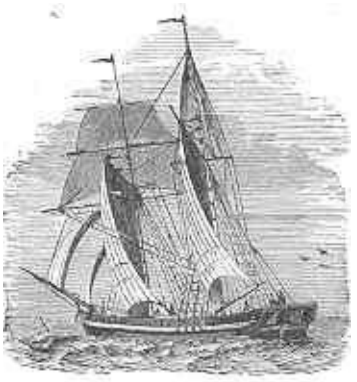


CUTTER-RIGGED YACHTS.

just described. They are *clipper-built*—that is, the hull is smoothly and sharply shaped; the cut-water, in particular, is like a knife, and the bow wedge-like. In short, although similar in general outline, a cutter-yacht bears the same relation to a trading-sloop that a racer does to a cart-horse. Their sails, also, are larger in proportion, and they are fast-sailing vessels; but, on this very account, they are not such good *sea-boats* as their clumsy brethren, whose bluff or rounded bows rise on the waves, while the sharp vessels cut through them, and often deluge the decks with spray.

In our engraving we have several cutter-rigged yachts sailing with a light *side* wind, with main-sail, gaff, fore-sail, and jib set.

The Schooner.



SCHOONER.

This is the most elegant and, for small craft, the most manageable vessel that floats. Its proportions are more agreeable to the eye than those of any other species of craft, and its rig is in favour with owners of yachts,—especially with those whose yachts are large. The schooner's distinctive peculiarities are, that it carries two masts, which usually "*rake aft*," or lean back a good deal; and its rig is chiefly fore-and-aft, like the sloop. Of the two masts, the *after* one is the *main-mast*. The other is termed the *fore-mast*. The sails of a schooner are—the *main-sail* and the *gaff*, on the main-mast; the *fore-sail*, *fore-top-sail*, and *fore-top-gallant-sail* (the two last being square sails), on the foremast. In front of the fore-mast are the *staysail*, the *jib*, and the *flying-jib*, these last are triangular sails. If a schooner were cut in two in the middle, cross-wise, the front portion would be in all respects a sloop with a square top-sail; the stern part would also be a sloop, minus the bowsprit and the triangular sails *before* the mast. Schooners sometimes carry a large square-sail, which is spread when the wind is "dead aft." They are much used in the coasting-trade; and one of their great advantages is that they can be worked with fewer "hands" than sloops of the same size.

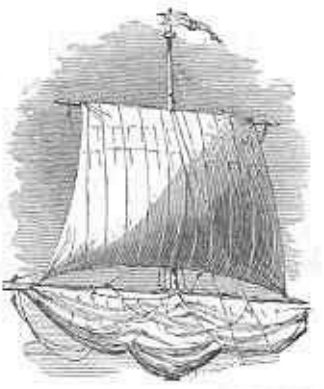
The Brig.

Advancing step by step in our investigation of the peculiar rig and build of ships, we come to the *brig*. This species of craft is usually, but not necessarily, larger than those that have been described; it is generally built on a larger scale than the schooner, and often approaches in magnitude to the full-sized, three-masted ship.

The distinctive features of the brig are, that it has *two* masts, both of which are *square-rigged*. It is a particularly serviceable species of craft, and, when of large size, is much used in foreign trade.

The advantage of the square-rig over the fore-and-aft rig is, that the sails, being smaller and more numerous, are more easily managed, and require fewer men or "hands" to work them. Thus, as we increase the size of our vessel, the more necessity is there that it should be square-rigged. The huge main-sail of the sloop and schooner could not be applied to large vessels; so that when men came to construct ships of several hundred tons burden, they were compelled to increase the *number* of masts and sails, and diminish the size of them; hence, probably, brigs were devised *after* schooners. The main-mast of a brig is the aft one.

The sails are named after the masts to which they are fastened,—namely, the *main-sail*, above that the *main-top-sail*, above that the *main-top-gallant-sail*, and



THE ROYAL SAIL SET, AND TOP-GALLANT CLEWED UP READY FOR FURLING.

sometimes a very small sail, named the *royal*, is spread above all. Behind the main-sail there is a small fore-and-aft sail similar to the main-sail of a schooner, which is called the *boom-main-sail*. On the fore-mast is a similar sail, which is called the *try-sail*. Attached to the respective yards of square-rigged ships there are smaller poles or arms, which can be pushed out at pleasure, and the yard lengthened, in order to receive an additional little sailor wing on each side. These wings are called *studding-sails* or *stun-sails*, and are used only when the wind is fair and light. They are named after the sails to which they are fastened; thus there are the *main-stun-sails*, the *main-top-stun-sails*, and the *main-top-gallant-stun-sails*, etcetera. The fore-mast of a brig is smaller than the main-mast. It carries a *fore-sail*, *fore-top-sail*, *fore-top-gallant-sail*, and *fore-royal*. Between it and the bowsprit are the *fore-stay-sail*, *jib*, and *flying-jib*. The three last sails are nearly similar in *all* vessels. All the yards, etcetera, are hoisted and shifted, and held in their position, by a complicated arrangement of cordage, which in the mass is called the running-rigging, in contradistinction to the standing-rigging, which, as we have said, is *fixed*, and keeps the masts, etcetera, immovably in position. Yet every rope, in what seems to a landsman's eye a bewildering mass of confusion, has its distinctive name and specific purpose.

Brigs and schooners, being light and handy craft, are generally used by pirates and smugglers in the prosecution of their lawless pursuits, and many a deed of bloodshed and horror has been done on board such craft by those miscreants.

The Brigantine.

The rig of this vessel is a mixture of that of the sloop and brig. The brigantine is *square*-rigged on the fore-mast, and sloop-rigged on its after or mizzen mast. Of its two masts, the front one is the larger, and, therefore, is the main-mast. In short, a brigantine is a mixed vessel, being a brig forward and a sloop aft.

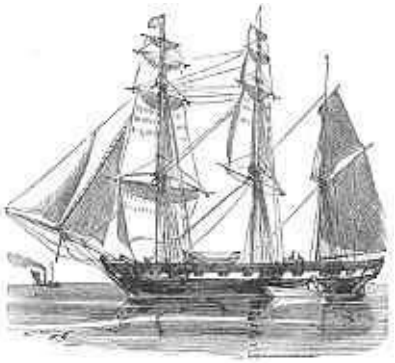
Such are our coasting-vessels; but it must be borne in mind that ships of their *class* are not confined to the coast. When built very large they are intended for the deep ocean trade, and many schooners approach in size to full-rigged "ships."

Chapter Seven.

Vessels of Large Size.

We now come to speak of ships of large size, which spread an imposing cloud of canvas to the breeze, and set sail on voyages which sometimes involve the circumnavigation of the globe.

The Barque.



BARQUE.

This vessel is next in size larger than the brig. It does not follow, however, that its being larger constitutes it a barque. Some brigs are larger than barques, but *generally* the barque is the larger vessel. The difference between a barque and a brig is that the former has *three* masts, the two front ones being square-rigged, and the mizzen being fore-and-aft rigged. The centre mast is the main one. The rigging of a barque's two front masts is almost exactly similar to the rigging of a brig, that of the mizzen is similar to a sloop. If you were to put a fore-and-aft rigged *mizzen-mast* into the after part of a brig, that would convert it into a barque.

The term *clipper* simply denotes that peculiar sharpness of build and trimness of rig which insure the greatest amount of speed, and does not specify any particular class. There are clipper sloops, clipper yachts, clipper ships, etcetera. A clipper barque, therefore, is merely a fast-sailing barque.

The peculiar characteristics of the clipper build are, knife-like sharpness of the cut-water and bow, and exceeding correctness of cut in the sails, so that these may be drawn as tight and *flat* as possible. Too much bulge in a sail is a

disadvantage in the way of sailing. Indeed, flatness is so important a desideratum, that experimentalists have more than once applied sails made of *thin planks of wood* to their clippers; but we do not know that this has turned out to be much of an improvement. The masts of all clippers, except those of the sloop or cutter rig, generally rake aft a good deal—that is, they lean backwards; a position which is supposed to tend to increase speed. Merchant vessels are seldom of the clipper build, because the sharpness of this peculiar formation diminishes the available space for cargo very much.

The Ship.

The largest class of vessel that floats upon the sea is the *full-rigged ship*, the distinctive peculiarity of which is, that its three masts are *all* square-rigged together, with the addition of one or two fore-and-aft sails.

As the fore and main masts of a "ship" are exactly similar to those of a barque, which have been already described, we shall content ourself with remarking that the *mizzen-mast* is similar in nearly all respects to the other two, except that it is smaller. The sails upon it are—the *spanker* (a fore-and-aft sail projecting over the quarter-deck), the *mizzen-top-sail* and *mizzen-top-gallant-sail*, both of which are square sails. Above all these a "ship" sometimes puts up small square-sails called the *royals*; and, above these, *sky-sails*.

Chapter Twelve.

Wooden and Iron Walls.

The birth of the British Navy may be said to have taken place in the reign of King Alfred. That great and good king, whose wisdom and foresight were only equalled by his valour, had a fleet of upwards of one hundred ships. With these he fought the Danes to the death, not always successfully, not always even holding his own; for the Danes at this early period of their history were a hardy race of sea-warriors, not less skilful than courageous. But to King Alfred, with his beaked, oared war-ships, is undoubtedly due the merit of having laid the foundation of England's maritime ascendency.

England under the Normans does not seem to have greatly desired to excel in maritime enterprise, but it was otherwise during the Plantagenet period. Henry the Second possessed a most formidable fleet, numbering some five hundred vessels of war. During the reign of his successor a novel artifice in naval warfare was resorted to by the English which merits notice. The English admiral caused a number of barrels of unslaked lime to be placed in his ships. Having brought his fleet to windward of the enemy—the French—he ordered water to be poured on the lime. This of course raised a great and dense smoke, which, being blown by the wind into the very faces of the French, prevented the latter from seeing on what quarter they were being attacked. A panic arose, and spread, among the French vessels, and the victory fell easily to the English.

The navy of Edward the Third numbered eleven hundred ships when he undertook the invasion of France. But the great majority of these were not properly men-of-war—in fact, there were only five fully equipped warships; the rest were for the most part merchant vessels converted into fighting ships and transports for the

time being. The navy of King Philip of France, though numerically weaker, far surpassed that of the English king in point of equipment. Of the four hundred ships of which it consisted, no fewer than one hundred had, been built purposely for war, according to the best principles of naval architecture then known. Bows, catapults, javelins, and weapons of a like description were the engines of offence used on both sides, and with these much havoc was wrought at close quarters. The English were victorious, notwithstanding the more scientific equipment of their foes. The French ships were boarded, and the flower of King Philip's naval force must that day have perished.

Henry the Seventh did much for the improvement of the English navy. It was during his reign that the *Great Harry* was built, which was really the first large ship built directly for the Royal Navy. Hitherto the vessels employed by England for national defence or offence had been supplied by certain maritime towns; but the *Great Harry* was the property of the people. She was built in 1488, and had port-holes for cannon in the lower deck, being the first vessel thus constructed. The *Great Harry* was subsequently far surpassed by another of King Henry's ships, the *Grace de Dieu*, which was no less than one thousand tons burden, and carried seven hundred men and one hundred and twenty-two guns, (some writers mention only eighty guns) the largest of which were but eighteen-pounders. The *Grace de Dieu* was a four-masted vessel, and was built in 1515.

An epoch in England's maritime history, which was in some respects the most brilliant and momentous, now falls to be mentioned; a period when England's name became a synonym on the seas for everything that was most intrepid and successful in maritime enterprise; an era of daring adventure and splendid achievement, which at length established England as the first naval power among

the nations of Europe.

Not without long and fierce struggle, however, was this supremacy won. The French, Spanish, and Dutch each and all in turn disputed England's claim to the sovereignty of the seas. It is unnecessary to repeat here the oft-told tale of the defeat of the Spanish Armada, nor yet the almost as familiar story of our frequent naval encounters with the Dutch in the days of Admiral Blake and the great Dutch Admiral Van Tromp. Long and desperate those conflicts were, and nothing but indomitable courage and stubborn perseverance could have secured the victory for the English ships, for in almost every instance our foes were numerically the stronger.

In the thrice famous days of Nelson, it was still our "wooden walls" which carried the flag of England on from triumph to triumph. At the battle of Trafalgar the *Victory* and the French ship the *Redoubtable* were brought up close alongside of each other, and in this position poured volley after volley upon each other's bulwarks, until water had to be thrown over the ships' sides to prevent them igniting. The *Victory* was a grand ship in her time, yet she was not more than two thousand tons burden, and her guns were but one hundred and two in number.

But at last the day arrived when it became manifest that the glory of our "wooden walls" had set. In the prime of his intellectual and physical strength, the Emperor Louis Napoleon was a man of active and subtle brain, and it was to his ingenious invention that the first ironclad ship of war owed its birth. Floating batteries protected with iron plates were first employed during the Crimean War. It was becoming manifest that the great strides which were being made in the manufacture of cannon must necessitate an improved system of defensive armour

for ships of war. No wooden vessel that could be constructed could be proof against the new guns that were now coming rapidly into use.

The French, as has been just indicated, were the first in the field with the new style of war-ships. *La Gloire* was built, and was quickly followed by our own *Warrior*. The frame of *La Gloire* was constructed of wood, but covered with an iron plating four and a half inches in thickness. The *Warrior* was built on an iron frame, and her armour-plating is of the same thickness as that of *La Gloire*; the lining is of solid teak eighteen inches thick, which is again backed by an inner coating of iron. The length of the *Warrior* is three hundred and eighty feet, but only about two-thirds of this is iron-plated.

At this time—the early days of ironclads—the heaviest shot that could be thrown by any gun was a sixty-eight pounder. Guns of this calibre the *Warrior* and her class were proof against. But the guns increased rapidly in size and power, and the thickness of the armour with which the ships were protected had to be increased in proportion. The class of war-vessels which succeeded the *Warrior* were entirely cased with iron plates, whose thickness has from time to time been increased. Since the first ironclad was built, then, a contest—for only such it can be called—has been going on between the cannon-maker and the ship-builder, the one striving to construct a gun which shall pierce the thickest armour which the ship can carry, the other adding inch upon inch to his armour plates, to the end that they may be shot-proof; and this contest may be said to be going on at this hour.

Will there ever be the same romance about the warships of the present day,—what those of the future will be like we do not care to speculate,—and the old "wooden walls" whose prowess on the high seas founded England's maritime glory? Will a

Dibdin ever arise to sing a *Devastation* or a *Glatton*? Can a *Devastation* or a *Glatton* ever inspire poetic thoughts and images? One would say that the singer must be endowed in no ordinary degree with the sacred fire whom such a theme as a modern ironclad turret-ship should move to lyric utterance. It has been said that all the romance of the road died out with the old coaching days; and certainly a locomotive engine, with its long black train of practical-looking cars, makes hardly so picturesque a feature in the landscape as one of the old stage-coaches with its red-coated driver, horn-blowing guard, and team of mettled greys; but a railway train is an embodiment of poetry compared with a turret-ship. But if it be true that poetry and romance must more and more cease to be associated with our navy, we must just accept the fact, for nothing is more certain than that, whatever the warships of the future *may* be, we can never again return to the days of the old wooden ships.

Several opposing difficulties have now to be met in the construction of ironclads. Invulnerability as regards the enemy's guns, protection to the men on board, speed, and the quality of being easily managed at sea,—all these points have to be carefully considered; and the difficulty is that one quality wars against another. A ship might be built which was proof against any guns that could be devised, and then might be found utterly unmanageable and unsafe at sea. A balance of qualities has therefore to be struck, and this perfect equipoise has by no means been as yet attained. Every year—we might say every month—witnesses the birth of some new type of armour-plated war-ship, built in every case at an enormous cost. The new sea-monster looks formidable enough in all conscience; but the question that arises the instant she quits the dock is, Is she sea-worthy? And with the fate of the *Captain* and the *Vanguard* in our memories, the question may well arise. The story

of modern war-ships has, up to this, been one of mingled success and failure. Does not the epigram on our war-ships—our "sub-marine fleet"—owe its point and sting, in a measure, to its truth?

Of the various types of modern war-vessels, the most formidable yet devised are undoubtedly the *steam-rams* and *turret-ships*. The steam-ram is armed with a strong steel beak, with which it charges an enemy in much the same way as the war-galleys of ancient times charged a foe, or as a sword-fish attacks its adversary. The turret-ship carries one or more shot-proof circular turrets, in which one or more guns are worked by the crew, the guns being capable of being turned and pointed in any direction. Both turret-ships and steam-rams are, of course, iron plated.

Vessels of this description were first employed by the Americans in the great civil war. The careers of the *Merrimac* and *Monitor* may be said to have become a part of American national history. The *Merrimac* was the first iron-plated steam-ram. She was originally a wooden frigate; was cut down, coated with iron, and furnished with a ram. In her famous encounter with the *Congress* and the *Cumberland*, two wooden frigates of the Federals, she steamed alongside the former, delivered a raking fire, and then, turning upon the *Cumberland*, attacked that vessel with her ram. Of the *Cumberland* she made quick work; for having torn a gaping rent in her side, she poured a damaging fire into the gap, hanging on by the sharp iron beak with which steam-rams are furnished.

Then withdrawing to a short distance, she again charged her adversary, and delivered a second terrible fire, until the *Cumberland* finally sank. The Merrimac then turned her attention to the *Congress*, whose fate she sealed in about half an

hour. The first shot caused fearful destruction, killing every man at one of the guns, blowing away the bulk-heads, strewing the deck with a carnage too horrible to dwell upon, and finally setting the ship on fire. The *Congress* at last struck her colours, but during the night she blew up.

This formidable vessel had subsequently to haul down her colours before the *Monitor*—in a figurative sense, that is, for she did not actually surrender, but retreated after a contest of some hours. In this notable struggle the *Merrimac* sustained much damage, without succeeding in inflicting on her enemy anything like the same amount of injury; in fact, the *Monitor* came out of the action scathless.

The changes that are taking place in the construction of war-ships are so various and so rapid, that we cannot attempt to do more here than take note of a few of the principal; and even what are mentioned as novelties now, before these pages appear may have ceased to be novelties.

Iron is now employed in almost every part of a war-ship, the masts themselves being in many cases of iron—hollow tubes through which the running rigging may be let down when there is danger of its being damaged by the enemy's fire. The majority of modern ironclads are built in compartments, with this advantage that, if damage is sustained in one part of the vessel, and the water rush in through the gap made by shot or any other cause, the ship will still float until the water can be let out again.

The American ironclad turret-ship *Monitor* has given her name to a whole class of vessels built within recent years for the English navy; but in many respects our vessels are superior to their American prototype. All these ships—which are

characterised by low free-boards and absence of masts and sails—fight their guns from turrets. They are sometimes known as "coast-defence ships," from the circumstance that they were constructed mainly for home service.

Of these "English monitors," four—the *Cyclops*, *Gorgon*, *Hecate*, and *Hydra*—are built on identically similar principles. In appearance they may be best compared to a raft with a battery on top of it, from which fortress or battery rise various funnels and a flag-staff. The deck is but three feet and a half above the level of the sea. While the ships are in port the deck is roofed in with an awning and railed round; but both awning and railing are removed when the vessels put to sea.

The battery or fortress is in the centre of the ship, and fills up about one-third of her length and three-fourths of her breadth. The surrounding deck is flush, its surface being broken only by the skylights, which are three in number. The skylights allow but a scant and dim light to penetrate to the officers' and seamen's quarters below; but even this is wanting in time of action, when a shot-proof shield takes the place of the glass windows.

The deck of the dass of war-ships we are describing is composed of twin-layers of iron plating half an inch each in thickness, supported on iron beams, and of two layers of solid teak lining four inches thick. The sides of the ships are protected by iron plating of eight-inch thickness amidships, which is an inch more of iron than the armour possessed by the majority of our masted sea-going ironclads, many of which are twice or thrice the size of the *Cyclops* and her sister-ships. It will thus be seen that these turret-ships are practically stronger in defensive equipment than any other class of ironclad cruisers.

The battery of these vessels is surrounded by a breastwork six feet in height, plated with nine-inch armour. Entrance is gained to the turrets themselves from inside this breastwork. In the centre of the turret there are two cylinders, the one fitting over the other in a manner which keeps the whole steady even in rough weather. Small steam-engines placed inside the breastwork serve to turn the turrets, which, however, can also be worked by manual labour should necessity demand it.

The ports present a striking contrast to those in the old wooden ships, by reason of their greatly diminished size. They just admit of the muzzle of the gun peeping through, and no more, being oval in shape, and about three feet in diameter lengthways. There can be little doubt that these small ports are an advantage, since they must afford greater protection to the gunners during action. When it is desired to alter the direction of the guns, the change is not effected by moving them in the ports, but by revolving the turret itself. Should it ever happen in action that the free movement of the turret should become impeded from some cause, then the only means of changing the direction of the guns would be to turn the whole ship.

The turrets are armed with two twenty-five ton guns, carrying four hundred pound shot. The deck being flush, as has been mentioned, the guns can be fired straight ahead and astern, and command all sides. Less than one minute is needed to revolve the whole turret. This class of ships is believed to be able to keep up a constant steady fire whether in chase or in retreat.

Abaft the funnel in these ships there is an upright oval tube rising some seventeen feet above the level of the main deck, plated with iron. The upper plate is pierced

with several small horizontal slits, from which the tube has received the name of the "conning-house," for through these openings the captain can "con" or note whatever is going on outside, without himself being exposed to danger. This circular box just allows the captain to turn himself about in; and here must he stand in time of action, directing and governing the whole conduct of his ship by mechanical telegraphs.

Of the many curious and remarkable features in these ships, one of the most remarkable is the extensive use made of machinery for every purpose. Engines revolve the turrets, raise the ashes from the engine-rooms, turn the capstans, work the rudders;—engines do everything.

Three monitors similar to those just described were built for the defence of several of our colonies. The colony of Victoria, we believe, purchased their ironclad, the *Cerberus*, from the home Government; at any rate, the people maintain her at their own cost. Before the *Cerberus* could make the voyage out to Melbourne, her sides had to be built up with thin iron plating for nearly her whole length. In the same way the *Cyclops* and her companion-ships might be made fit to face any sea or weather.

It may occur to the reader to ask, Why not have sea-going masted vessels at once? To which it may be answered, first, that the masted ships must inevitably draw more water than those of which the *Cyclops* and *Hecate* are types. Turret-ships like the *Monarch*, or broadside-ships like the *Hercules* and *Sultan*, draw about twenty-five feet of water; the smaller ships only sixteen, while at the same time they are more heavily armoured. Thus the latter, if close pressed by an enemy's sea-going ironclads—the only class from which they have much to fear—could take

shelter up a river out of their reach. In action near the land these monitors, moreover, could be handled with greater ease.

Secondly, from their much smaller size, the coast-defence ships are built at a much less cost—an important consideration in days when a first-class ironclad costs about as much as a small fleet of bygone days. The vessels we have been describing are of rather more than two thousand tons burden, as compared with the five thousand tons of the larger sea-going ships; and, speaking roughly, the expense of construction is proportionate to the tonnage.

The *Glatton* turret-ship has several characteristics in which it differs from the above class of monitors. It has but a single turret, and its guns throw six hundred pound shot, carrying three miles and a half. Her water-draught is about six feet more than that of the *Cyclops* and *Hecate*, and her armour-plates three inches thicker. Though she carries fewer guns, the *Glatton* is a much more powerful vessel than the other monitors. (Note: The above description of English monitors is adapted and abridged from an article in Chambers's Journal.)

We shall now briefly describe the *Devastation*, one of the largest and most powerful of all our ironclads. The *Devastation* in her after-part rises but four feet and a half above the water; but to meet bad weather she is furnished with an armour-plated half-raised forecastle, so that forward she is nine feet out of the water. The free-board amidships is still higher, being at this point level with the platform on which the two turrets are placed. In the centre of the ship rises a circular iron erection, on the top of which is the hurricane-deck. Through this structure runs a passage, in which are situated the entrances to the hatchways and to the hurricane-deck overhead.

From the hurricane-deck rise the ship's two funnels; and here also are the captain's fighting box, already alluded to in describing the coast-defence ships, the fire-proof shield for protecting the steering gear, and the boats. In a gale the hurricane-deck is the only safe place in ships of this kind—the only place where one would not get speedily washed overboard. As for the below part of the ship, it is there almost impossible to breathe, even when air has been pumped in from above, which is the only means of ventilating this portion of the vessel.

The *Devastation* carries two guns in each of her turrets, placed side by side, each weighing thirty-five tons. The turrets, directly the guns have been fired, can be wheeled rapidly round, thus turning the exposed parts away from the enemy.

Ships such as the *Devastation*, the *Thunderer*, and the *Fury* do not, at first sight, strike one as particularly well adapted for rough weather, to put it in the mildest phrase. Nevertheless, the *Devastation* has been fairly well tested in this way, having encountered some pretty rough weather, and, it is affirmed, behaved satisfactorily. The great danger about all ships of this class is that they may not rise to the seas, but that the waves, breaking over them, may press them down and founder them. The *Thunderer* has been known to have her forecastle, which is somewhat lower than that of the *Devastation*, completely submerged, and this, too, when no very high sea was running. These ships are designed, not for home service and coast defence merely, but for general action in mid-ocean.

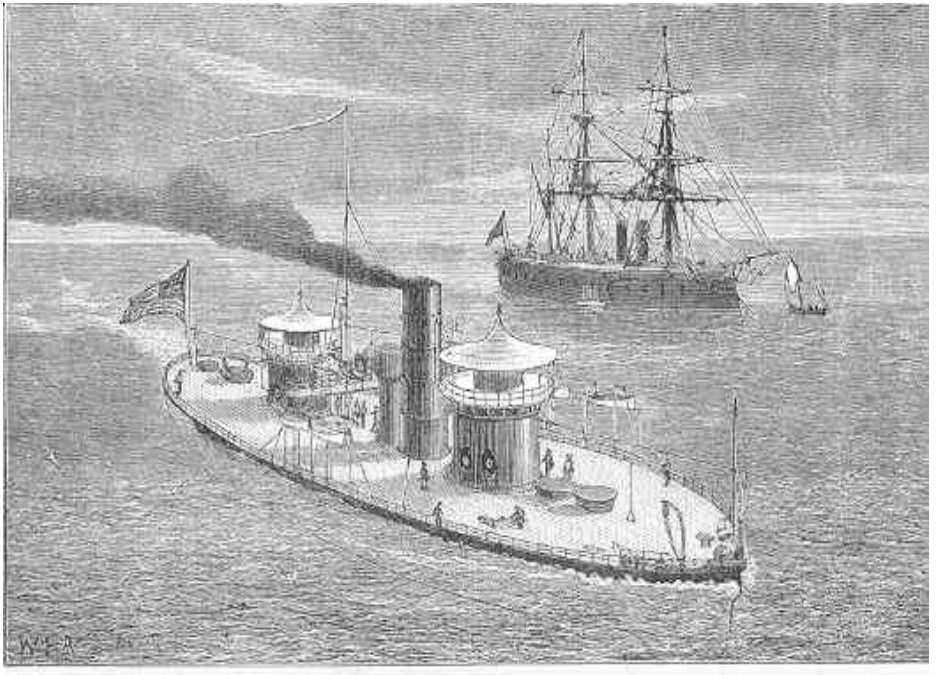
To attempt to describe even a single specimen of each type of modern war-ships would to a certainty weary the reader, for to any but an expert there would inevitably be a sense of repetition in the perusal of such a narrative. But in order to place before our readers something like an approximate idea, at any rate, of the

present state of our navy, we shall examine briefly one other first-class ironclad, the *Inflexible*, which may be regarded as a leading example of ironclad ships, and, at the time of writing, as one of the highest achievements of modern naval architecture.

The *Inflexible* is the vast size of 11,400 tons burden, her horse-power being 8000. The length is 320 feet, her armour-plating from 16 to 24 inches thick, with an inner lining of wood from 17 to 25 inches in thickness. She is divided into 135 compartments, and her engines are placed at such a distance from each other that should one be disabled from any cause the other would still be in working order.

The chief characteristic of the *Inflexible* is the position of the turrets. The majority of ships of this description have their turrets in the middle line, from which it results that only one half of their guns can be directed on an enemy, whether ahead or astern. The *Inflexible* has her turrets on each side—the fore-turret on the port-side, the after-turret on the starboard. She can thus use the whole of her guns against an enemy *at the same time*, whether it be ahead or astern.

It will be seen that the thickness of the armour-plating with which the *Inflexible* is protected is enormous; and yet this thickness of iron has been pierced. The question, then, that immediately suggests itself is, *Can* a vessel be constructed to carry much heavier armour-plating than this? A recent writer in the *Times* declares not. "So far as the exigencies of the navy are concerned," he says, "the limit of weight seems to have already been reached, for the simple reason that the buoyancy of our ironclads cannot with safety be further diminished by the burden of heavier armour and armaments."



THE "MIANTONOMA." *Page 18.*

The following very graphic description of the interior of a turret-ship was written by an eye-witness of the scene described. It is an extract from a narrative supplied to the author of "The Sea: its Stirring Story of Adventure and Peril," from which we take it. The vessel described was the *Miantonoma*, an American ironclad turret-ship.

"You ascend again through a trap-door, and find yourself in a circular room, some twelve feet in diameter, padded from top to bottom like the interior of a carriage. By your side is a huge mass of iron. You are inside the turret. A glimmering lamp sheds its feeble light on the moving forms around you, and from below comes the faint whispering of the men, until the trap is shut and you are again in utter silence.

"'*Prepare*!' The gunner's mate stands on your toes, and tells you to lean forward and thrust your tongue out of your mouth. You hear the creaking of machinery. It is a moment of intense suspense. Gradually a glimmer of light—an inch—a flood! The shield passes from the opening; the gun runs out. A flash, a roar—a mad reeling of the senses, and crimson clouds flitting before your eyes—a horrible pain in your ears, a sense of oppression on your chest, and the knowledge that you are not on your feet—a whispering of voices blending with the concert in your ears—a darkness before your eyes—and you feel yourself plump up against the padding, whither you have been thrown by the violence of the concussion.

"Before you have recovered sufficiently to note the effects I have endeavoured to describe, the shield is again in its place and the gun ready for reloading. They tell you that the best part of the sound has escaped through the port-hole, otherwise there would be no standing it, and our gunner's mate whispers in your ears, 'It's all werry well, but they bu'sts out bleeding from the chest and ears after the fourth discharge, and has to be taken below.' You have had enough of it too, and are glad that they don't ask you to witness another shot fired."

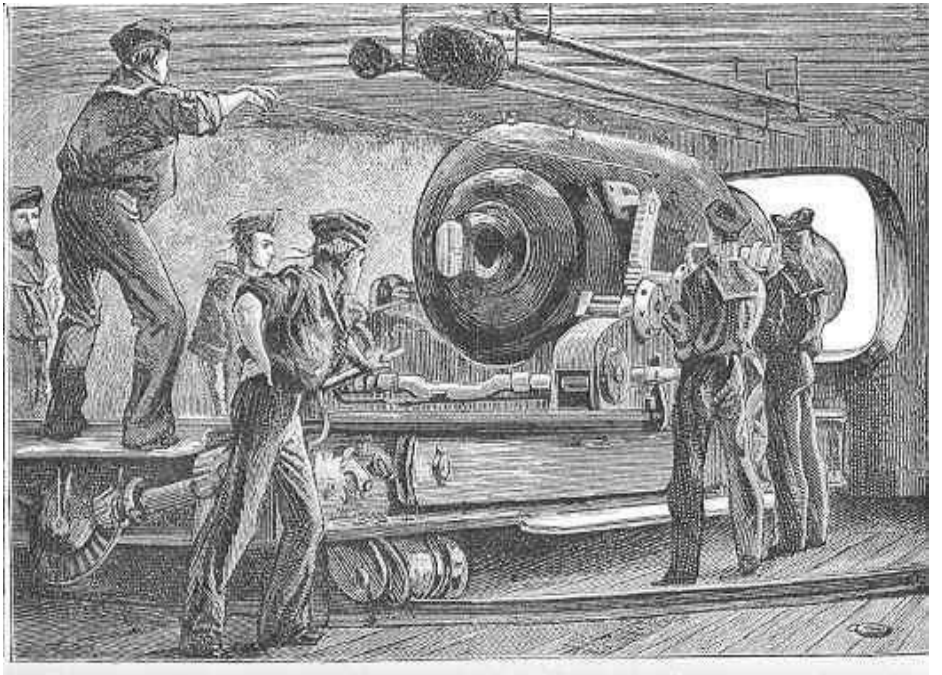
It must be stated that since the *Miantonoma* was built a new and improved principle of turret-firing has been introduced. Electricity is now employed in discharging the guns, and there is thus no necessity for anyone being in the turret, which is of course a great advantage.

At the close of the civil war, America possessed a fine fleet of monitors, of which scarcely any now remain. For the time they seemed all but impregnable to shot and shell; but they were built by contract, of unseasoned wood, and in the course of ten or twelve years yielded to natural decay. But the *Brooklyn* and the *Ohio*, both fine

examples of naval architecture, still survive to maintain, in so far as two ships can, America's maritime prestige.

A chapter treating of ironclads would, we think, be incomplete without allusion made to the loss of the *Captain*, whose terrible fate in 1870 has caused a mournful interest to be attached to that vessel.

The *Captain* was 320 feet in length and 53 feet broad. Her armour-plating reached to five feet below the water-line. Opposite the turrets her plating was eight inches in thickness and seven inches in other parts. The ship was furnished with two screws, placed side by side. The screws were available for steering, and thus the vessel could be governed without the rudder. The *Captain* was fully rigged, and could carry a large spread of canvas.



INTERIOR OF TURRET.

The special characteristic of the ship was her revolving turrets. Each turret was 27 feet in diameter on the outside and 22 feet 6 inches on the inside. The walls of the turrets were therefore 2 feet 3 inches thick; and one half of this thickness was composed of iron. The turrets were revolved by separate engines, but they could also be turned, if occasion required, by hand-labour. Two Armstrong twenty-five ton guns, throwing six hundred pound shot, were placed in each turret. The ship was built after designs by Captain Coles—the architect also of the *Monarch*.

On her first sea-voyage the *Captain* showed, apparently, such excellent sea-going qualities that her architect and the contractors, the Messrs Laird, were quite satisfied as to her safety in mid-ocean. In the autumn of 1870 she accompanied the

fleet on a cruise; and on the 6th of September, shortly after midnight, foundered off Cape Finisterre. The whole crew were lost, with the exception of nineteen men, and among those who perished was Captain Coles himself, Captain Burgoyne, the commander of the ship, and a son of the then First Lord of the Admiralty—Mr Childers. It is unnecessary to recall to the memory of the adult among my readers the deep feeling of pity and gloom spread by this awful disaster throughout Great Britain.

The night on which the *Captain* foundered was no doubt a somewhat rough one, with squalls and a heavy sea on; but it was not merely the force of the storm which overwhelmed the vessel.

Mr James May, a surviving gunner of the ill-fated ship, gave a sufficiently clear account of the foundering of the vessel. Soon after midnight he was awakened from sleep by a noise and a feeling that the ship was uneasy. Rising, and taking with him a lamp, he proceeded to the after-turret to see if the guns were all right. Everything was secure enough there; but he had hardly finished his examination when he felt the vessel heel steadily over, a heavy sea struck her on the weather-port, the water rushed into the turret, and May presently found himself in the water.

He swam to the pinnace, which he perceived floating bottom upwards, and there he was presently joined by Captain Burgoyne and several others of the crew. Then he beheld the vessel turn over and go down, stern first; the whole catastrophe being over in a few minutes. The launch was drifting a few yards off, and May called out to his comrades, "Jump, men! it is our last chance." May with three others succeeded in reaching the boat, in which fifteen of the remainder of the crew also found a refuge. It is uncertain whether poor Captain Burgoyne remained in the

pinnace or failed to reach the launch.

The nineteen survivors, after a hard row of twelve hours, without food or drink, landed at Cape Finisterre, where they were hospitably received and cared for by the people. A court-martial was held in due course to investigate the cause of the disaster. Into the details of the evidence it is impossible here to enter, but it was sufficiently proved that there were grave faults in the *Captain's* construction,—faults which, as is unfortunately too often the case, were not discovered by such calculations as were made before the ship started on what may be said to have been her first, as it was her last, cruise. It had, however, been noticed by some that the vessel was about a foot and a half deeper in the water than she should have been—that her free-board, in a word, instead of being eight feet above the water, as was designed, was only six feet six inches; and it needs but a very slight knowledge of marine matters to understand how this difference would materially prejudice the stability of such a vessel as the *Captain*.

If it has been the reader's chance, as it has been ours, to visit anyone of our great naval arsenals—especially Portsmouth or Plymouth—he cannot have failed of being struck with the gallant and splendid appearance presented by many of our ships of war; but he must likewise have been affected with feelings the reverse of admiration by more than one type of modern ironclads. No one who admires a real ship, be it of wood or of iron—a stately frigate in full sail before a favouring wind—can at the same time admire a monitor. Many persons, in truth, will refuse to regard a turret-ship as a ship at all. It overturns our every notion of what a ship should look like. A low, black, mastless, raft-like, cruel-looking machine, without the faintest pretension to form or comeliness, a turret-ship is simply a fighting-engine, a floating battery—an ingenious and formidable instrument of death and

destruction, no doubt, but nothing more. Yet these are among the leading war-ships of the present, and, as far as can at present be seen, of the immediate future; and on these we must depend for the protection of our shores should they ever be threatened.

And yet, great as is the annual cost of our navy, and great as is the amount of ingenuity spent in the construction of new and novel ships of war—each designed to be more impregnable and more formidable than its predecessor—our navy is at this moment in somewhat of an unsettled and transitory state. Changes in the construction of ironclads are every year taking place, and considerable difference of opinion exists among our highest naval authorities upon important points in marine architecture. Ships of war have now to contend with such formidable enemies in the shape of guns, torpedoes, and other engines of terribly destructive power, that it is difficult to say at present which will eventually triumph. One of the old wooden ships placed beside a modern ironclad is as a child's toy battery compared with Gibraltar; and yet it can hardly be said that the nation has the same feeling of confidence and security in our present ships which it reposed in the vessels which Nelson so often led to victory; for it must be long ere the fate of the *Captain* and the *Vanguard* is entirely forgotten.

Of this, however, we may, we think, at least rest assured, that, however dubious we may be in regard to some of the novelties and presumed improvements that are being from time to time introduced in naval architecture, England is well abreast of the age in maritime matters; if her ships be not absolutely perfect, and proof against every form of danger, they are at least equal to those of any other nation. We need a strong, a very strong navy; and as a fact our naval resources are nearly equal to the combined naval strength of Europe.

A somewhat different condition of things will need to come about from that which at present exists among the nations of the world ere England can afford to decrease her naval armaments; and until the Great Powers of the world agree to settle their disputes by some other means than by "wager of battle," and are resolved to "war no more," probably the best and only way for her is to keep herself as strongly and perfectly armed as possible. It is this that has probably helped, at any rate, to secure so long and uninterrupted peace for our shores; and to try a different and opposite course would, to say the least, be a risk. It is upon her navy, as all the world knows, that England depends for defence and security. To be weak in our navy would be to be weak throughout all our armour. Our navy is at present, we would fain hope, a peace-weapon in our hands—a shield, not a sword; and while it is such, the stronger and more flawless it is, the better for us, and perhaps for the world at large. This may strike the reader as a somewhat vain-glorious, "spread-eagle" way of putting the case; but if he look at the matter fairly and impartially, we think he will admit that there is some truth in our statement.

Before closing this chapter, a word or two must be said descriptive of that fell foe to ships of war, the torpedo, though space demands that our reference should be brief. Almost all modern ships of war are constructed with false bottoms, designed especially to protect them against torpedoes. There are many different forms of torpedoes, employed in a variety of ways. A torpedo may be described as a submarine exploding apparatus. It may contain from thirty to as much as five hundred pounds of gunpowder; and the explosion is effected either by means of electricity, or by a spring and a detonating substance when the engine comes in contact with a ship. Some kinds of torpedoes rest on the bottom of the sea, while others are anchored and float suspended in the water. If a vessel strikes against

one of these terrible engines, she is either at once blown to splinters, or a rent is made in her bottom which causes her rapidly to sink.

One type of torpedoes resembles somewhat a fish, and is impelled rapidly through the water by a screw and other machinery. Torpedoes are so constructed as to be able to rise and strike a vessel just at the right moment. When not filled with gunpowder or gun-cotton, dynamite and other explosive substances are used instead for charging these submarine war-engines.

Various methods have been devised to secure ships from torpedoes. Nets are sometimes extended in front of the ship, which catch the torpedoes before they can come in contact with the vessel's bottom. This safeguard was adopted, in many instances with success, by the Federal war-ships when entering Confederate harbours. But a great deal may be done to secure a ship against these terrible engines of destruction by precaution simply, as was proved in the Crimean War, when the Russian torpedoes did little or no damage to our ships, by reason of the unceasing watchfulness maintained on board.

During the late war between Russia and Turkey one of the most daring exploits of the campaign was an attack by a Russian squadron of torpedo-boats on the Turkish monitor *Hifse Rahman*. The flotilla comprised four ships, the *Czarevich*, the *Xenia*, the *Czarevna*, and the *Djirid*. The two first named began the attack, the *Czarevna* and the *Djirid* holding themselves in reserve until their assistance should be wanted.

The launches were equipped with strong iron awnings which shielded their crews from the enemy's fire. Each boat was armed with two torpedoes, fastened to the

end of long spars projected over the bulwarks and working on pivots. The torpedoes could be detached from the spars when occasion demanded; while long chains were secured to the missiles, by which they were attached to the enemy's vessel, as well as to the wire of a galvanic battery fastened round the waist of the commander of the launch. This battery was the means by which the torpedo was exploded.

The flotilla left the Roumanian side of the Danube on the 25th of June 1877 at about midnight, and in something less than an hour the *Hifse Rahman* loomed in sight, a shadowy mass on the dark waters. The approach of the torpedo-boats was almost noiseless, and the croaking of the frogs was said to have further favoured the Russians by drowning the sound of the engines, so that those on board the monitor were not aware of their enemy's propinquity until the launches were almost alongside.

The sentry at once challenged, when Lieutenant Doubarsoff, the commander of the *Czarevich*, answered "Friends." But his speech betrayed him; the alarm was spread; and the *Hifse Rahman* opened a sharp fire upon the launches. But Lieutenant Doubarsoff succeeded in attaching his torpedo-chain to a rope hanging at the monitor's bows, and then rapidly backed his little vessel and fired the torpedo. A tremendous explosion; a column of water shot up into the air, and the launch was nearly swamped! A breach had, however, been made in the *Hifse Rahman's* bulwarks.

The other monitors were now thoroughly alive to their danger, and the Russian launches had to sustain a deadly cannonade, upon which Lieutenant Doubarsoff ordered Lieutenant Schestakoff to bring up his launch, the *Xenia*, and apply a

second torpedo, which the latter was able to do, attaching the missile amidships of the Turkish vessel. The fate of the *Hifse Rahman* was now sealed, and in a few minutes she sank.

The Russian launches succeeded in getting clear of their enemy again without losing a single man, and thus ended the first torpedo expedition ever made against an enemy's ironclads, but which may, as a writer describing the event says, "end in completely revolutionising our present system of monster iron walls." The Grand Cross of Saint George was awarded to Lieutenants Doubarsoff and Schestakoff for this intrepid and successful exploit.

Space is not left us to do more than revert for a moment to what is perhaps the deadliest weapon of offensive naval warfare yet devised,—rams. Some experts maintain that nothing can match the power of the ram of a modern ironclad skilfully handled; and a well-known naval authority has declared that the use of the guns in a naval action should be merely preliminary to that of the ram—in other words, that all effort should be concentrated upon making an opportunity of using the ram.

We close this chapter by recalling the reader's attention to a feature in modern war-ships already alluded to, and which indeed the whole course of our remarks upon this subject points to—the almost universal use of machinery in modern naval tactics. Most assuredly in modern sea-warfare it may be said, in the Laureate's words—used by him, of course, with a very different sense—that "the individual dwindles," so that the prediction, which some of our readers may remember was once made by a First Lord of the Admiralty, seems not unlikely one day to become sober fact—that the time will come when we shall no longer require sailors, because all that our warships will need will be stokers and artillerymen. Whether

this is a consummation to be desired we are not careful here to pronounce.

Chapter Thirteen.

Origins of Steamships—Ocean-Steamers, etcetera.

As we have been led, in writing about ships of the navy, to refer to steam, we turn aside at this point to treat of that tremendous motive-power.

One night, in the year 1807, a terrible sight was witnessed by the inhabitants of the banks of the river Hudson in America.

Men love what is marvellous, and they will go a long distance out of their way to see that which is terrific and horrible; but on the night in question there was no need to go far. The farmers had only to look out of their windows, and the sailors of the shipping had only to lift their heads above the bulwarks, to behold a sight that appalled the stoutest hearted, and caused the very hair on the craniums of the timid to stand on end.

The object that created so much consternation was—a "monster of the deep!" At some parts of the river, men could not tell what it was like, for the night was dark when it passed, but a dark, shadowy idea they obtained by the light of the fire which the creature vomited from its jaws; and they formed a tremendous conception of its size and power from the speed at which it travelled, the splashing which it made, and the hideous groans with which it burdened the night-air.

This "fiery monster of the deep" was the *first* river-steamer, the *Clermont*.

Before going further into the details of this the first of a class of ships which have, within the last fifty years, almost completely changed the whole system of navigation, let us take a cursory glance at the first attempts made to propel ships by means of steam.

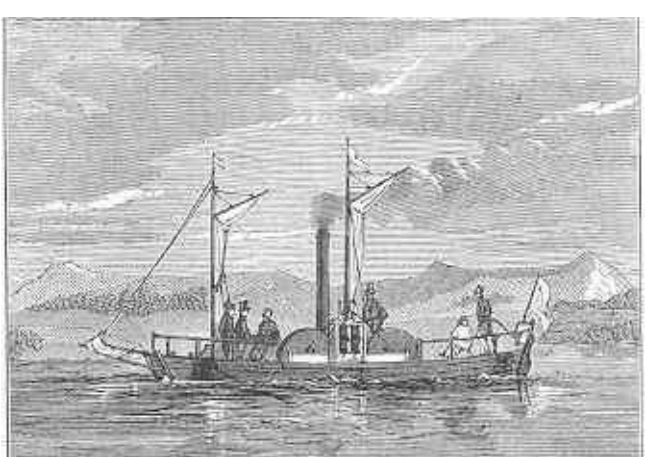
The subject has occupied mankind much longer than many people suppose. So long ago as the year 1543, a naval captain of Spain applied an engine to a ship of about two hundred tons, and succeeded in moving it at the rate of about two miles an hour. The nature of his engine the captain kept secret; but it was noted that part of it consisted of a caldron of boiling water.

This we are told by Thomas Gonzales, the director of the Royal Archives of Simancas; but his veracity is now called in question,—at any rate, nothing further was afterwards heard of the discovery.

The first authentic record we have of steam navigation occurs in a work written by the Marquis of Worcester in 1665, in which allusion is made to the application of engines to boats and ships, which would "draw them up rivers against the stream, and, if need be, pass London Bridge against the current, at low-water."

Many attempts, more or less successful, were made by ingenious men from time to time. Papin of France in 1690 constructed a steamboat, the success of which may be gathered from the fact that it was ultimately broken up by enraged and jealous watermen! Jonathan Hulls in 1736, and M. Genevois in 1759, were each successful, to a certain extent, in constructing working models, but nothing definite

resulted from their labours. Yet we would not be understood to undervalue the achievements of such men. On the contrary, it is by the successive discoveries of such inquiring and philosophical men that grand results are at last attained. The magnificent structures that crowd the ocean were not the creations of one era, or the product of one stupendous mind. They are the result of the labours of thousands of men whose names have never been known to fame.



MILLER'S STEAMBOAT.

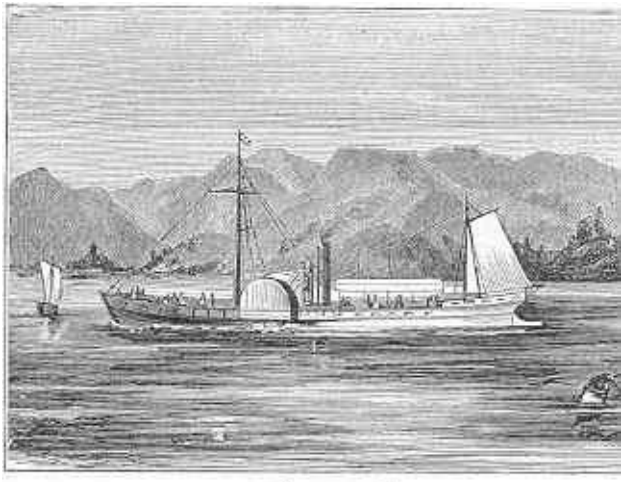
The men who, working upon the materials supplied by preceding generations, brought the propulsion of boats by steam nearest to perfection, *just before* the commencement of navigation, were Mr Miller of Dumfries, Mr Taylor, his friend, and tutor in his family, and Mr Symington. All of these were, in a very important degree, instrumental in ushering in the great event. Symington, in 1788, fitted an engine to a large boat, in which he attained the speed of seven miles an hour.

The man to whom the credit belongs of introducing *steam navigation* is undoubtedly

Mr Fulton of America. This gentleman, who was contemporary with those just mentioned, visited France and England, in the former of which countries he endeavoured, unsuccessfully, to carry out his projects, while in the latter he met with Symington, and obtained much valuable information from him.

We have no sympathy whatever with those who seem to rake in to the credit of their own country every discovery and invention they possibly or plausibly can. We did much *towards* the commencement of steam navigation, but we did not begin it. We pushed considerably in advance of other nations in the invention of apparatus by which boats might be propelled by steam; we constructed models, tried it on a small scale, and found the thing to answer admirably: but we rested there. Meanwhile, an enterprising American came and saw our achievements, ordered an engine in England, carried it across the Atlantic, and *commenced* the era of steam navigation, on the river Hudson, by building and launching:

The First Steamer.



THE "CLERMONT."

Robert Fulton, in conjunction with Chancellor Livingston of America, planned, built, and launched a boat in the spring of 1807, which they named the *Clermont*. It was propelled by steam, and averaged the rate of five miles an hour on its first voyage from New York to Albany, a distance of nearly one hundred and fifty miles.

All discoveries and novelties, great and small, are treated with ridicule at first by the mass of mankind, so it is not a matter of wonder that the crowds which flocked to the wharf to see the *Clermont* start on her first trip were somewhat satirical and jocose in their remarks. But when the steam was turned on, and they heard the first of that series of snorts that was destined ere long to shake the trembling air of land and sea, and saw the great, uncouth paddle-wheels revolve powerfully in the water and churn it into foam, a shout, tinged doubtless with prophetic fervour, greeted the triumphant engineer as his little steamboat darted from the shore.

Colden, in his Life of Fulton, speaks thus of the *Clermont's* first voyage:—

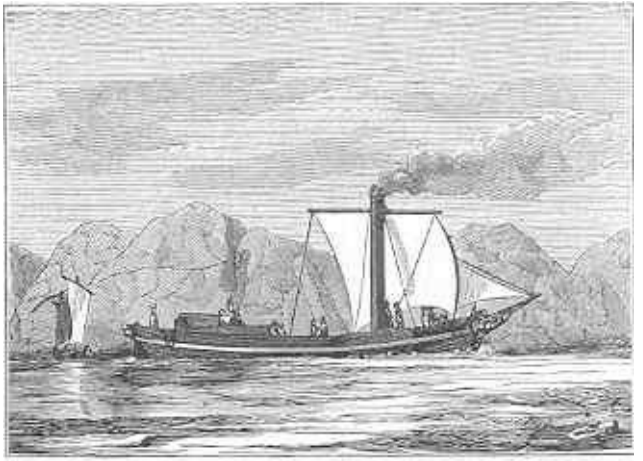
"She excited the astonishment of the inhabitants of the shores of the Hudson, many of whom had not heard even of an engine, much less of a steamboat. There were many descriptions of the effects of her first appearance upon the people of the banks of the river.

"Some of these were ridiculous, but some of them were of such a character as nothing but an object of real grandeur could have excited. She was described by some, who had indistinctly seen her passing in the night, as a monster moving on the waters, defying the winds and tide and breathing flames and smoke! She had the most terrific appearance from other vessels which were navigating the river when she was making her passage. The first steamboat (as others yet do) used dry pine wood for fuel, which sends forth a column of ignited vapour many feet above the flue, and, whenever the fire is stirred, a galaxy of sparks fly off, which, in the night, have a very brilliant and beautiful appearance.

"This uncommon light first attracted the attention of the crews of other vessels. Notwithstanding the wind and tide, which were adverse to its approach, they saw with astonishment that it was rapidly coming towards them; and when it came so near that the noise of the machinery and paddles was heard, the crews—if what was said in the newspapers of the time be true—in some instances shrank beneath their decks from the terrific sight, and left their vessels to go on shore; whilst others prostrated themselves, and besought Providence to protect them from the approaches of the horrible monster which was marching on the tide, and lighting its path by the fires that it vomited!" The *Clermont* became a regular passenger boat on the Hudson; and the progress of steam navigation continued to advance, until nearly all the navigable rivers of the world, and the great ocean itself, were covered with these clanking ships of commerce, which have added more to

the comfort, the wealth, and the power of man—the power of doing good as well as evil—than the feeble human mind can conceive.

The Comet.



THE "COMET."

It was not until five years after the Americans set us the example that we launched our first passenger steamboat, the *Comet*, a vessel of about twenty-five tons, with engines of three horse-power. This little vessel was started by Henry Bell, of Helensburgh, on the Clyde. It began its career in 1812, and plied regularly for two years.

Like her predecessor the *Clermont*, she was regarded with no small degree of scepticism, and with a large amount of surprise by the thousands who saw her set forth. Nevertheless, she soon proved her value, became a successful speculation to her owners, and was ere long followed by many other vessels of a similar kind.

The "Argyle", afterwards named "The Thames."

In 1813 the *Argyle* was launched. This vessel was the first European steamer that pushed out into the more dangerous navigation of the open sea-coast. She was purchased by a company in London. On her passage up, she was as nearly as possible wrecked on a lee-shore, but, by her steam-power, was enabled to go straight against the wind, at the rate of three and a half knots an hour, and so escaped.

One of the passengers has left us an interesting account of this interesting voyage, from which we cull one or two paragraphs:

"The weather had now become so stormy and bad that our captain determined to put in to the port of Wexford, his great object being to navigate the vessel safely to London, rather than, by using great despatch, to expose her to unnecessary risk. We put to sea again at two o'clock p.m., on May 30th, and steered for Saint David's Head, the most westerly point of Wales. During our passage across Saint George's Channel, one of the blades of the starboard paddle-wheel became out of order; the engine was stopped, and the blade cut away. Some hours afterwards, a similar accident happened to the other wheel, which was remedied in the same manner.

"About two-o'clock in the afternoon, twelve hours after leaving Wexford, we reached the pass of Ramsay. We remained there for three hours, to oil the engine, and to give the stoker, who had not quitted his post an instant since leaving Wexford, a little rest. In a short time several boats were seen coming to our assistance, the idea prevailing here, as at Wexford, that our vessel was on fire. We landed on the island of Ramsay, a most desolate spot, containing only one habitation; we,

however, procured some bread, butter, milk, cheese, and ale, with which we returned to the vessel, and commenced steaming through the straits, and across Saint Bride's Bay.

"The weather had now become unfavourable, and the sea ran alarmingly high in the bay. On the south side of Saint Bride's Bay, between Skomar Island and the mainland, is a nasty passage called Jack Sound. Our pilot warned us of the danger of attempting this passage, excepting at high-water and with a favourable wind, as there were several formidable whirlpools, which would seize the vessel and carry her on the rocks. Captain Dodd, however, who knew the power of his engine, insisted on going through the sound, in order to save five hours and another night at sea. The pilot repeated his remonstrances, at the same time trembling for fear; but we passed through all the whirlpools with the greatest ease. Nothing, however, can be conceived more frightful than the aspect of some of the rocks, and especially of those called the Bishop and his Clerks. Had we been in a sailing vessel, our position would have been most perilous; but our steam was all-powerful, and brought us safely to Milford Haven.

"We put to sea again late on the evening of the 31st, and on Friday morning we were in the middle of the Bristol Channel, with no land visible; but towards evening we discovered the high coast that terminates England in the west. As the weather, however, again assumed a gloomy aspect, our new pilot judged that it would be imprudent that night to double Land's End, so we shaped our course towards Saint Ives.

"On approaching the shore, we perceived a crowd of small vessels making towards us with all possible rapidity, by means of oars and sails. Here, as

elsewhere, the alarm was taken, on seeing a vessel, judged to be on fire, steering towards the town, and all the disposable craft immediately put to sea. All the rocks commanding Saint Ives were covered with spectators; and when we entered the harbour, the aspect of our vessel appeared to occasion as much surprise amongst the inhabitants as the ships of Captain Cook must have produced on his first appearance amongst the islanders of the South Seas.

"Another night passed, a night of storm and danger, but the little *Thames* (the vessel had been renamed by the new company who purchased her) behaved nobly, and next day reached Plymouth. Here," continues the narrative, "the harbour-master, who had never seen a steam-vessel before, was as much struck with astonishment, when he boarded the *Thames*, as a child is on getting possession of a new plaything. He steered the vessel, and we passed round several ships of war in the sound. The sailors ran in crowds to the sides of their vessels as we passed them, and, mounting the rigging, gave vent to their observations in a most amusing manner.

"We left Plymouth at noon on the following day, and steamed without interruption to Portsmouth, where we arrived on Friday, June 9th, having accomplished one hundred and fifty miles in twenty-three hours. At Portsmouth astonishment and admiration were, if possible, more strongly evinced than elsewhere. Tens of thousands of spectators were assembled to gaze on the *Thames*; and the number of vessels that crowded around us was so great, that it became necessary to request the admiral to give us a guard to preserve some degree of order.

"We entered the harbour in the most brilliant style, steaming in, with the assistance of wind and tide, at the rate of from twelve to fourteen miles an hour. A

court-martial was at the time sitting on board the *Gladiator* frigate; but the novelty of our steamboat presented an irresistible attraction, and the whole court came off to us, excepting the president, who was obliged by etiquette to retain his seat until the court was regularly adjourned. On Saturday, June 10th, the port-admiral sent his band and a guard of marines at an early hour on board; and soon afterwards he followed, accompanied by three admirals, eighteen post-captains, and a large number of ladies. The morning was spent in steaming amongst the fleet, and running over to the Isle of Wight. From Portsmouth we proceeded to Margate, which we reached on Sunday morning. Here we remained until the following day, when we embarked for our final trip, at half-past eight in the morning; and about six in the evening arrived at Limehouse, where we moored."

We have entered thus at considerable length into this voyage, because, besides being the first steam sea-voyage, it serves to exhibit very distinctly how great and how rapid has been the progress of steam-navigation within the last fifty years. In reading such an account as this, in these days of "ocean mail-steamers" and "Great Easterns," we can scarcely believe that in it reference is made, not to the middle ages, but to the year 1813.

Ocean-Steamers.

After that momentous era when steam was first successfully applied to useful purposes, human progress and improvement in all departments of science and art seemed to have been hooked on to it, and to have thenceforth rushed roaring at its tail, with truly "railroad speed," towards perfection!

Scarce had the first model steamboat splashed with its ungainly "blades" the

waters of a pond, than river traffic by means of steamboats began. And no sooner had this been proved to be a decided success, than daring schemes were laid to rush over the ocean itself on wheels. Men were not long about it, after the first start was made. Their intellectual steam was up, and the whirl of inventive effort racked the brains of engineers as the wheels of their steamboats tortured the waters of the deep.

And here again the name of Fulton comes into notice. Early in 1814 he conceived the idea of constructing a steam-vessel of war, which should carry a strong battery with furnaces for red-hot shot. Congress authorised the building of such a ship, and before the end of the same year it was launched. Fulton died the following year, but the fame of that enterprising engineer will never die.

The new vessel received the rather quaint title of *Fulton the First.* She consisted of two boats joined together. Those who were appointed by Congress to examine her and report, gave the following account of this curious man-of-war:

"She is a structure resting on two boats and keels, separated from end to end by a channel fifteen feet wide and sixty-six feet long. One boat contains the caldrons of copper to prepare her steam; the cylinder of iron, its piston, lever, and wheels, occupy part of the other. The water-wheel revolves in the space between them. The main or gun-deck supports the armament, and is protected by a parapet four feet ten inches thick, of solid timber, pierced by embrasures. Through thirty port-holes as many thirty-two pounders are intended to fire red-hot shot, which can be heated with great safety and convenience. Her upper or spar-deck, upon which several thousand men might parade, is encompassed by a bulwark, which affords safe quarters. She is rigged with two stout masts, each of which supports a large

lateen yard and sails. She has two bowsprits and jibs, and four rudders—one at each extremity of each boat; so that she can be steered with either end foremost. Her machinery is calculated for the addition of an engine which will discharge an immense column of water, which it is intended to throw upon the decks and through the port-holes of the enemy, and thereby deluge her armament and ammunition.

"If, in addition to all this, we suppose her to be furnished, according to Mr Fulton's intention, with hundred-pound columbiads, two suspended from each bow, so as to discharge a ball of that size into an enemy's ship ten or twelve feet below her water-line, it must be allowed that she has the appearance, at least, of being the most formidable engine for warfare that human ingenuity has contrived."

She certainly was; and even at the present time the *Fulton the First* would cut no insignificant figure if placed alongside our gunboats, floating-batteries, and steam-frigates.

It is not easy to get intelligent men to believe in things that savour of the marvellous; yet there seems to be a point past which, if once a man be got, he will go on to believe almost anything, no matter how absurd. In those days few people in Europe would credit the truth of this ship's proportions; but when, in the course of time and from indubitable testimony, they were compelled to believe, they flew to the opposite extreme of incredulity and believed anything, as the following curiously comical paragraph will show. It is said to have appeared in a Scotch treatise on steamships, and is intended for a "full, true, and particular account" of this monstrous American man-of-war steamer. After giving her dimensions three times larger than they were in reality, the author continues:— "The thickness of

her sides is thirteen feet of alternate oak plank and cork wood. She carries forty-four guns, four of which are hundred pounders; quarter-deck and forecastle guns, forty-four pounders: and further, to annoy an enemy attempting to board, can discharge one hundred gallons of boiling water in a minute; and, by mechanism, brandishes three hundred cutlasses with the utmost regularity over her gunwales; works also an equal number of heavy iron spikes of great length, darting them from the sides with prodigious force, and withdrawing them every quarter of a minute!" This vessel, although probably intended for an ocean-steamer, was never used as such. But not long after, a vessel propelled by steam ventured to cross the Atlantic, and thus became the parent of commercial steam navigation. This vessel was:

The "Savannah" Steamer.

Unfortunately, little information as to this, the first ocean-steamer, has been chronicled.

She was launched at New York on the 22nd of August 1818, and in the following year made her first voyage to Savannah, from which she sailed for Liverpool soon after, and crossed the Atlantic in twenty-five days—during eighteen of which she used her engines.

The *Savannah* was about 350 tons burden, and was on this occasion commanded by Captain Moses Rodgers. She was fitted with machinery for taking in her wheels in stormy weather, which was found to work admirably; and she is mentioned as having been seen on the ocean going at the rate of nine or ten knots.

From Liverpool this steamer went to Saint Petersburg, and afterwards returned to

Savannah in safety.

This was the insertion of the wedge. Our own country did not follow the lead until 1838, when the good people of New York were thrown into a state of excitement by the arrival of two steamers, the *Sirius* and the *Great Western*, from England. So long a time had elapsed since the voyage of the *Savannah* that men had well-nigh forgotten it, and were disposed to regard these vessels as the *first* ocean-steamers. Indeed, some narrow-minded and ungenerous writers have asserted that they *were* the first—totally ignoring the prior claim of the *Savannah*.

From that period ocean-steamers began to run frequently across the Atlantic. They now do so regularly, as well as to nearly all other parts of the world.

Ocean Mail-Steamers.

The improvements which have taken place during recent years in ocean-going steamships have been great and rapid. The speed attained by some of these magnificent vessels is little short of marvellous. Many persons still living can recollect the time when the voyage to Australia in a sailing vessel lasted six months. What is now the state of matters? By more than one line of steamships the traveller may reach Sydney or Melbourne within forty days. A recent voyage of the *Orient*, one of the latest and finest additions to ocean steamships, merits more than a passing notice. The *Lusitania*, which belongs to the same line, steamed from England to Australia in less than forty days, and the feat was regarded as a great one. But the *Lusitania* has been far outmatched by her sister-ship the *Orient*, which has actually accomplished the same voyage in thirty-five days, fifteen hours, and forty-six minutes. From Plymouth to the Cape of Good Hope took the *Orient* only

seventeen days twenty-one hours. This is the fastest speed on record. Whether it is the maximum rate possible to ocean steamships, or whether it is destined to be surpassed by a still higher degree of speed, remains to be seen. Many persons are of opinion that the increased facilities of speed which are now within reach of travellers on long voyages will gradually lead to the total disuse of sailing ships for passenger traffic. It may be so, but there are still not a few who would prefer a sailing to a steam ship for a long sea voyage, notwithstanding its so greatly inferior rate of speed. But nowadays everything must be sacrificed to *time*. "Time flies," is at present the motto of most instant and potent power with the world; but the day is perhaps not far off when the fiat, "Thus far, and no farther," must be pronounced not only on the speed of steamships, but on the breathless rush and hurry of the age in general.

The Czar's Yacht "Livadia."

Undoubtedly one of the most remarkable craft afloat is the Russian Czar's steam-yacht the *Livadia*. To a Scotch shipbuilding firm belongs the credit of having constructed this unique and splendid vessel, and it is certainly a feather in the cap of Messrs Elder and Company, the well-known Glasgow shipbuilders, from whose yard the *Livadia* was launched in July 1880.

One would imagine that the highest point of comfort and luxuriousness has been reached in the accommodation offered by the *Livadia*, but this is far from being the only or even the chief respect in which the vessel is remarkable. She is notable from a purely nautical point of view—being the outcome of principles that may be said almost to revolutionise all pre-existing ideas of shipbuilding, though something

like the same principle may be found in the circular ironclads of Admiral Popoff.

Hitherto the plan which naval architects have followed, where the desideratum was exceptional speed, was to give the vessel in course of construction length in combination with as fine lines and as perfect proportion as possible. But in the case of an imperial pleasure-boat, like the *Livadia*, it was an object to obtain an ampler and more drawing-room like accommodation than is compatible with length, narrowness of beam, and fine lines; and the constructors of the Czar's new yacht have succeeded in securing not only this internal spaciousness and comfort, but also a satisfactory degree of speed.

It was to the united exertions of Admiral Popoff of the Russian navy, and Dr Tideman of the royal dockyard, Amsterdam, that the design of the *Livadia* was due. It is not easy in words to convey a distinct impression of this curiously-shaped craft, but our description will, we hope, give the reader a pretty correct idea of the vessel.

The constructors of the *Livadia*, it is believed, chose a turbot as their model for the hull; and in thus taking a flat fish as a suggestion for their vessel, the builders, as a recent writer on the subject points out, followed no extravagant, though certainly a novel, fancy. In broad terms the *Livadia* may be described as a wide and shallow oval in shape, half submerged, while over this turbot-shaped raft a superstructure is erected, somewhat similar in appearance to an ordinary vessel, and comprising large, lofty, and sumptuous saloons and other apartments.

The *Livadia* is 260 feet long, 150 feet broad, and 50 feet deep. She is 11,609 tons burden, and her displacement 4000. The two leading merits of the *Livadia*, due to its peculiar construction, are—first, that its frame can support a superstructure of

almost palatial proportions such as would founder any other vessel; and second, that its great breadth of beam keeps the ship as steady as a ship can possibly be, while, at the same time, its lower lines secure a very good degree of speed.

The *Livadia* possesses powerful propelling engines. There are three sets of these, each with three cylinders, the diameter being sixty inches for the high pressure, and seventy-eight inches for the low, with a stroke of three feet three inches. As much strength and lightness as possible have been secured for the propellers by constructing them of manganese iron; while steel has been largely employed for the engines and boilers, which are, for their weight, the most powerful possessed by any vessel. The estimated horse-power is 10,500, and the ship, under favourable conditions, can make fifteen knots an hour.

The double water-tight bottom of the *Livadia* is three feet six inches deep at the centre, and two feet nine inches at each end. In this turbot-like lower part is the machinery, and it is the receptacle also for coals and stores of all kinds. The twofold bottom of the ship comprises forty compartments, and the whole is sufficiently strong, it is believed, to withstand the heaviest weather to which the yacht is likely to be exposed, as well as the strain of her powerful machinery.

The entire length of the upper part of the ship, in which are the imperial apartments, and the quarters of the officers and crew, is 260 feet, and the breadth 110 feet. The crew all told numbers 260. The private apartments of the Czar himself are forward on the main-deck, well away from the heat of the engines and the smell of the machinery. A visitor to the ship is chiefly struck, perhaps, by the height to which the decks rise above the hull, the uppermost compartment of all being fitted out as a reception saloon, in the centre of which a little fountain rises out of a

bed of flowers. This portion of the vessel is forty feet above the level of the sea. The apartment is luxuriously appointed in the fashion of the reign of Louis XVI. The drawing-room is furnished in a style of equal sumptuousness, in the Crimean Tartar style; but the rest of the imperial apartments are in a simpler order of decoration. Behind the funnels there is another deck-house, containing the captain's quarters and rooms for the Grand Duke Constantine. It will thus be seen that the *Livadia* is literally a floating palace, equipped and decorated with that almost Eastern love of sumptuous display which characterises the Russians as a people.

All the three screws with which the *Livadia* is furnished are wholly submerged in the water—another novelty in the construction of the vessel. One or even two of these screws might suffer serious injury and the ship still remain manageable.

It is not wonderful that the launch of a craft, at once so splendid and so curious, should have caused much interest and excitement in the neighbourhood in which it took place. A distinguished company witnessed the ceremony, while the crowd which lined the banks of the river Clyde numbered 10,000. A short service was conducted by three priests of the Greek Church, and the bows of the vessel were then sprinkled with holy water. After the conclusion of this ceremony, the yacht received her name from the Duchess of Hamilton, and was then launched. The launch was a complete success, the *Livadia* taking the water in gallant style, though the task was one of more than ordinary difficulty from the circumstance of the great breadth of the ship's keel-less bottom, which much increased the friction to be overcome. At the luncheon which concluded the day's proceedings, Mr Pearce, the chairman, who represented the firm of Elder and Company, stated that the principle adopted in the building of the *Livadia* would probably be more useful in the

case of ships of war than of merchant vessels, but that builders of the latter might also derive valuable hints from the construction of the new ship. Whether this will prove to be the case time has yet to show.

A most interesting discovery of a Norse war-ship has recently been made at Sandefjord in Norway. The vessel, there can be no doubt, is one of the kind in which those formidable buccaneers, the Norsemen, used to harry the coasts of Great Britain and France ten hundred years ago. It was found buried in the ground, and seems to have been the sepulchre of some great Viking chieftain, who had probably many a time sailed forth in it to the terror and detriment of some less warlike and powerful neighbour.

The ship is unusually large, and very completely equipped. Its length is about seventy-five feet; and sails, rigging, a number of shields and other instruments of battle, were found on board.

Chapter Fourteen.

The "Great Eastern."

The *Great Eastern* steamship deserves to be regarded as the eighth wonder of the world, beyond all question. She is at present by far the largest vessel in the world, and is the most magnificent creation of naval architecture that was ever launched upon the sea.

The substance of the following account of this interesting ship has been gathered

principally from the Times and the Illustrated London News for 1859, the year in which the *Great Eastern* was launched, and from a pamphlet which was sold on board, by permission of the proprietors.

The *Great Eastern* was intended for the Indian and Australian route by the Cape of Good Hope. The result of large experience in steam navigation has proved that the size of the ship, (when steam is used), ought to be in proportion to the length of the voyage. Mr Brunel, the talented engineer to whose genius and perseverance this monster ship owes her existence, acting on this principle, calculated that the voyage to Australia and back being 22,500 miles—a vessel of 22,500 tons burden, (or a ton burden for every mile to be steamed), would require to be built, capable of carrying fuel for the entire voyage, it being impossible, without incurring enormous expense, to procure coal for such a vessel at intermediate ports.

The Eastern Steam Navigation Company undertook the herculean work. The total cost of construction was estimated at 804,522 pounds. Mr Brunel prepared the designs. A spot of ground was chosen on the banks of the Thames, in the building-yard of the company at Millwall, and the building was commenced, on the lines laid down by Mr Scott Russell, on the 1st of May 1854.

Every minute detail of the arrangements and building of this wonder of the world is fraught with interest. The mere preparing of the ground to receive her enormous weight was calculated to fill the minds of men with astonishment. Her supports and scaffoldings, and the machinery by which she was ultimately launched, taxed the skill of her engineers even more than her construction. A very town of workshops, foundries, and forges sprang into being round her hull; and as this rose, foot by foot, in all its gigantic proportions, the surrounding edifices dwindled down into

insignificance, and the busy population of artificers clustered upon her like ants upon a prostrate monarch of the forest-trees.

The hull of the *Great Eastern* is built entirely of iron, and is 680 feet in length, 83 feet in breadth, and 60 feet in height from keel to deck. It is divided transversely into ten separate compartments of 60 feet each, rendered perfectly water-tight by bulk-heads, having no openings whatever lower than the second deck; whilst two longitudinal walls of iron, 36 feet apart, traverse 350 feet of the length of the ship.

The mind will be better able to realise the magnitude of these dimensions if we add that the *Great Eastern* is six times the size of the Duke of Wellington line-of-battle ship, that her length is more than three times the height of the Monument, while her breadth is equal to the width of Pall Mall, and a promenade round the deck affords a walk of more than a quarter of a mile.

There is no keel properly so called, but in its place a flat keel-plate of iron, about two feet wide and one inch thick, which runs the entire length from stem to stern. This is the base upon which all the rest is reared, plates and girders alike. The iron plates which form her planking are three-quarters of an inch thick. Up to the water-mark the hull is constructed with an inner and outer skin, two feet ten inches apart, both skins being made of three-quarter inch plates, except at the bottom, where the plates are an inch thick; and between these, at intervals of six feet, run horizontal webs of iron plates, which bind the two skins together, and thus it may be said that the lower part of the hull is two feet ten inches thick.

This mode of construction adds materially to the safety of the vessel; for, in the event of a collision at sea, the outer skin might be pierced while the inner might

remain intact. This space may also at any time be filled with water, and thus ballast, to the amount of 2500 tons, be obtained.

Some idea of the magnitude and weight of the vessel may be formed from the fact that each iron plate weighs about the third of a ton, and is fastened with a hundred iron rivets. About thirty thousand of these plates were used in her construction, and three million rivets. The fastening of these rivets was one among the many curious operations performed in course of building. The riveting men were arranged in gangs, each gang consisting of two riveters, one holder-up, and three boys. Two boys were stationed at the fire or portable forge, and one with the holder-up. This boy's duty was to receive the red-hot rivet with his pincers from the boy at the forge, and insert it in the hole destined for its reception, the point protruding about an inch. The holder-up immediately placed his heavy hammer against the head of the rivet, and held it firmly there, while the two riveters assailed it in front with alternate blows, until the countersunk part of the hole was filled up, after which the protruding head was cut off smooth with the plate, the whole operation scarce occupying a minute. In riveting the double part of the ship the holder-up and his boy were necessarily in the interior part of the tubes, and passed the whole day in the narrow space between, (of two feet ten inches wide), in comparative darkness, having only the glimmer afforded by a single dip candle, and being immediately under the deafening blows of the riveters.

The *deck* of the *Great Eastern* is double, or cellular, after the plan of the Britannia Tubular Bridge. The upper deck runs flush and clear from stem to stern, and he who takes four turns up and down it from stem to stern walks upwards of a mile. The strength of this deck is so enormous that if the ship were taken up by its two extremities, with all its cargo, passengers, coals, and provisions on board, it would

sustain the whole. The deck has been covered with teak planking, and has been planed and scrubbed to man-of-war whiteness. Not even a stray rope's end breaks the wonderful effect produced by its immense expanse. Her fleet of small boats, which are about the size of sailing cutters, hang at the davits, ten on each side. There are six masts and five funnels. The three centre square-rigged masts are of iron. They were made by Mr Finch of Chepstow, and are the finest specimens of masts of the kind that were ever manufactured. Each is made of hollow wrought iron in eight-feet lengths, strengthened inside by diaphragms of the same material. Between the joints, as they were bolted together, was placed a pad of vulcanised india-rubber, which gives a spring and buoyancy to the whole spar greater than wood, while at the same time it retains all the strength of the iron. The other masts are made of wood, and the canvas that can be spread is no less than 6500 square yards. On deck are four small steam winches or engines, each of which works a pair of cranes on both sides of the vessel; and with these five thousand tons of coals can be hoisted into the vessel in twenty-four hours.

The *engines* and boilers are of immense power and magnitude. There are both screw and paddle engines, the former being capable of working up to 6500 horse-power, the latter to 5000. There are ten boilers and one hundred and twelve furnaces. The paddle engines, which were made by Messrs Scott Russell and Company, stand nearly 40 feet high. Each cylinder weighs about 28 tons, and each paddle-wheel is 58 feet in diameter, or considerably larger than the ring in Astley's Circus. The screw engines were manufactured by Messrs Watt and Company of Birmingham. They consist of four cylinders of 84 inches diameter and 4 feet stroke. The screw propeller is 24 feet in diameter and 37 feet pitch; and the engine-shaft is 160 feet long, or 12 feet longer than the height of the Duke of York's Column. The

paddles and screw, when working together at their highest pitch, exert a force equal to 11,500 horsepower, which is sufficient to drive all the cotton-mills in Manchester! The consumption of coal to produce this force is estimated at about 250 tons per day.

Besides these engines there are also several auxiliary engines for pumping water into the boilers, etcetera.

The passenger accommodation in the *Great Eastern* is very extensive—namely, 800 first-class, from 2000 to 4000 second-class, and about 1200 third-class passengers; or if troops alone were taken, it could accommodate 10,000 men.

The *saloons* are fitted up in the most elaborate and costly manner. The chief saloon is magnificently furnished. It is said that the mirrors, gilding, carpeting, and silk curtains for this apartment alone cost 3000 pounds. In the berths, of course, no attempt is made at costly decoration of this kind, though the fittings are good and sufficiently luxurious. The berths are arranged in three classes: those for parties of six or eight, and these are large rooms; those for parties of four; and the rest in the usual style of double cabins. All are very roomy, as cabins go—very lofty, well lit, and those on the outer sides exceedingly well ventilated. On the lower deck the berths are even larger, loftier, and more commodious than those on the upper. Both the berths and saloons here are in fact almost unnecessarily high, having very nearly fifteen feet in the clear. The kitchens, pantries, and sculleries are all on the same extensive scale, and fitted with all the large culinary requisites of first-class hotels. The ice-house holds upwards of 100 tons of ice; and the lofty wine-vaults—for such in fact they are—contain wine enough to form a good freight for an Oporto trader.

Miscellanea.—In addition to the boats of the *Great Eastern* (twenty in number), she carries two small screw-steamers, each 100 feet long, 16 feet broad, 120 tons burden, and 40 horse-power, suspended aft of the paddle-boxes.

As the captain's voice could not be heard half-way to the bow, even with the aid of the ancient speaking-trumpet, that instrument is supplanted by *semaphore* signals by day, and *coloured* lamps by night; the *electric telegraph* is also used in connection with the engine-rooms. There are ten *anchors*, four of them being Trotman's patent, weighing seven tons each. The *cables* are each 400 fathoms long, and their united weight is 100 tons. The *tonnage* of the *Great Eastern* is 18,500 tons register, and 22,500 tons builders' measurement. The *crew* at first consisted of thirteen officers, seventeen engineers, a sailing-master, and a purser, four hundred men, and two or three surgeons, all under the command of the late Captain W. Harrison, (formerly of the Cunard line).

The *launch* of this leviathan was a most formidable undertaking, and was accomplished by means of powerful hydraulic rams, which propelled the vessel down the launching "ways." The ship rested on two gigantic cradles, and was forced sideways down the inclined plane, until she floated on the river. By a complication of ingenious contrivances the great ship was regulated in her descent so as to proceed slowly and regularly down the ways. Several unsuccessful attempts were made to launch her, and several of the hydraulic rams broke down ere she floated on the bosom of Old Father Thames; and the cost of this operation alone is said to have been nearly 100,000 pounds.

The *trial of the engines*, both screw and paddle, took place for the first time on the 8th of August 1859, when the completion of the vessel was celebrated by a banquet

on board. The first movement of the gigantic cranks and cylinders of the paddle engines was made precisely at half-past one, when the great masses slowly rose and fell as noiselessly as the engines of a Greenwich boat, but exerting in their revolutions what seemed to be an almost irresistible power. There was no noise, no vibration, nor the slightest sign of heating. The tremendous frame of ironwork sprang at once into life and motion, with as much ease as if every rod and crank had been worked for the last ten years.

The *trial trip* of the *Great Eastern* was an event that excited intense interest all over the kingdom. For the first time, she cast off her moorings on Wednesday morning, (the 7th September), and reached the Nore on Thursday, where she anchored for the night before proceeding to sea. On Friday morning, at ten minutes past nine, she started on her first salt-water voyage. A conviction of the extreme steadiness of the vessel must speedily have seized everyone on board. There was no perceptible motion of any kind. The giant ship was speedily surrounded by yachts, tugs, fishing-smacks, and, indeed, by a representative of almost every kind of vessel which is prevalent at the Nore. These accompanied her as far on her way as their limited sailing powers would permit. Although there were sharp squalls and a chopping sea nearly all through the trip, not the slightest inconvenience was felt by any of the visitors, not even among the fairer portion of the passengers. The morning, which was rather fine at starting, suddenly became clouded, and the shifting squalls increased in violence. Though the squally state of the weather damped the pleasure of all on board, yet it afforded an opportunity of trying the properties of the ship, now under paddle as well as screw; and it was the wish of Mr Scott Russell and all on board to meet a good gale of wind. At a moderate computation, the distance from the deck to the water could not be much less than

forty feet, while the vessel is nearly seven hundred feet long. This area would, of course, present an enormous surface to the force of the wind, and formed the subject of considerable discussion as to the effect it would have on her sea-going qualities. The ship was as stiff and steady as though she still remained on her cradles in the Isle of Dogs, and her course was as calm and true as though she were on a lake without a capful of wind.

It is said that at one portion of the voyage she steamed nineteen miles an hour.

The *explosion*.—All went well till the ship had passed Folkestone. About half-past five o'clock, while the majority of the passengers were on deck, and a few gentlemen only remained in the dining saloon, a tremendous explosion occurred, and in an instant showers of broken glass, and fragments of wood and iron, came crashing through the skylight. Those in the cabin rushed on deck. The ship was still pressing onward; at either end all was still and deserted, while in the centre all was smoke, fire, vapour, and confusion. The great funnel, of eight tons weight, had been shot up as if from a mortar, and fell on the deck broken in two pieces. The whole centre of the ship seemed to be only one vast chasm, and from it were belching up steam, dust, and something that looked like incipient conflagration. Captain Harrison acted nobly on this terrible occasion. He had been standing on the bridge overhead, looking into the binnacle, and the moment he heard the report, and whilst the destructive shower was still falling fast, he jumped upon the deck, and ordered an immediate descent to the ladies' saloon, in the firm conviction that they were all there as on the previous evening. But many of the men were panic-stricken, and had already shrunk away from the explosion. A foolish passenger had raised a cry of "The boats," and, assisted by some of the sailors, was madly attempting to let them down. In one moment all would have been lost; for the rush to the boats

would have been general, and hundreds been drowned, whilst the noble ship would have been left to certain destruction. But the voice of the captain was heard like a trumpet, calling out, "Men, to your duty; officers, to your posts; give me a rope, and let six men follow me!" The effect of this short address was electric. In an instant he had slid down the rope into the saloon, followed by his brave boatswain Hawkins, and six volunteers were not long wanted for the forlorn hope. One after another he dashed open the gilded panels; but the splendid apartment had, strange to say, only two inhabitants,—his little daughter Edith, and her pet dog. It was the reward of his gallantry that his own child should be thus the one to be so providentially saved. But even then he did not for a moment lose his self-command. Snatching up the child, and with one glance seeing that she was unharmed, he exclaimed, "Pass her along to the deck; there are more rooms to be searched." In this way did he move about rapidly, but coolly, and did not again return to the deck until he had satisfied himself that not a single woman was in the burning, steaming, suffocating chamber. His intimate friend, Mr Trotman, who had followed him down almost immediately, found the poor lap-dog moaning under a heap of ruins, and was the means of restoring it to its little mistress.

The magnificent saloon was a mass of torn and shattered furniture, mirrors, and ornaments. Had the passengers adjourned to this apartment after dinner, instead of to the deck, the consequences would have been awful.

An eye-witness describes the scene of devastation as follows:—

"The mirrors which formed the covering of the funnel which had been the cause of so much mischief were literally smashed to atoms, and large fragments of the broken glass were hurled upon deck, a long distance aft of the paddle-wheels. The

ornamental bronzed columns which supported the gilt cornices and elaborate ornamentation, were either struck down or bent into the most fantastic shapes; the flooring, consisting of three-inch planks, was upheaved in several places; the gangways leading to the sleeping-cabins at the sides were shot away; the handrails were gone, and the elegant carpet was concealed beneath a chaos of fragments of finery. The books on the shelves of the library remained unmoved; the piano was thrown on one side; and the floor presented huge upheaved and rent chasms, through which might be seen the still greater ruin in the lower cabin. Below the saloon, or drawing-room, is the saloon of the lower deck, which was, of course, traversed by the same funnel as the one above it. On each side of these spacious saloons were small staircases leading to blocks of sleeping-cabins, scarcely one of which would have been without its two or more occupants a few hours later in the evening. They were now blown down like a house of cards. The furniture which they contained formed heaps of dislocated chairs, and wash-stands, and basins; the doors were off their hinges, the partitions were forced outward, the staircases leading to them had to be sought in the splinters and broken wood which lay in heaps in the lower saloon."

The unhappy men who were working in the stoke-holes and tending the furnaces were the sufferers by this catastrophe. Believing that one of the boilers had exploded, fears were entertained that the whole body of stokers and engineers attending the paddle engines were killed. Mr Trotman went down the air-shaft communicating with the other boilers. Seeing by the light of the furnaces a number of men moving about, he inquired if they were all right, and the response sent up from these lowest depths of the ship was, "All right at present, but we don't know how long." They were told to keep quiet, and stay where they were; that they could

be of no service on deck, and all would be well in a few minutes. The gallant fellows remained by their fiery furnaces with resolute good-will. In the case of the firemen tending the other set of boilers a very different scene was taking place. Ropes were thrown down, and, one by one, wounded, bleeding, and staggering men were drawn up, their black, begrimed faces forming a ghastly contrast with scalded portions of their limbs and bodies. The men were taken aft to the hospital, and to the cabins, where mattresses and blankets were laid for them.

Two or three of these poor fellows walked up to the deck almost, if not quite, unassisted. Their aspect told its own tale, and none who had ever seen blown-up men before could fail to know at a glance that some had only two or three hours to live. Where not grimed by the smoke or ashes, the peculiar bright, soft whiteness of the face, hands, or breast, told at once that the skin, though unbroken, had in fact been boiled by the steam. One man walked along, and seemed quite unconscious that the flesh of his thighs, (most probably by the ashes from the furnace), was burnt in deep holes. To some one who came to his assistance he said quietly, "I am all right. There are others worse than me; go and look after them." This poor man was the first to die. It was seen at once that but little hope existed for many, if not the majority, of the sufferers, who were twelve in number. Most of them seemed very restless, and almost, if not quite, delirious; but a few of those whose injuries were likely to be more immediately fatal remained quiet, half unconscious, or at most only asking to be covered up, as if they felt the cold. For these latter all knew that nothing whatever could be done, as, in fact, they were then dying.

The explosion had occurred in the double casing round the bottom of one of the funnels. We have not space to describe this minutely, and by the general reader the description, were it given, would scarce be understood; but it is well to remark that

the piece of machinery which caused the deplorable accident had been previously condemned in strong terms by competent judges, and there is no doubt that the hot-water casing round the funnel ought never to have been there.

After the catastrophe, the *Great Eastern* kept on her course as though nothing had happened, although the force of the explosion was sufficient to have sent any other ship to the bottom. The damage was estimated at 5000 pounds. She arrived at Portland on the 10th, and remained there for some time undergoing repairs. Afterwards she continued her trial trip to Holyhead, where she arrived on the 10th of October. The results of the trial, excepting, of course, the accident, were most satisfactory. Her speed under disadvantageous circumstances had been good, and her engines had worked admirably. Against a gale of head wind she went as steadily as if in harbour, but with the wind a-beam she rolled considerably. Altogether there was good reason to hope that the *Great Eastern* would fulfil the sanguine expectations of her warmest admirers.

The following account of the continuation of her trial trip from Portland to Holyhead, as gathered from the *Times*, is exceedingly interesting:— When steam was up, and all ready for starting from Portland, the crew were sent forward to heave up the anchor. Eighty men sufficed to drag the *Great Eastern* up to and over her moorings. Bringing the anchor out of the ground, however, was not so easily managed; and it was not till all the musical resources known to sailors on such occasions were nearly exhausted that the tenacious gripe of Trotman's patent was released, when a slow drift with the tide showed that the great ship was again set free. In another minute, without shouting, confusion, or hurry of any kind, and with less noise than is made by a 100-ton coaster, a slight vibration through the ship, with a thin line of foam astern, showed that the screw engines were at work and

the vessel once more under way. With such ease, with such perfect quietness and good order was everything accomplished, that the occasional cheering from the yachts and steamers was almost the first token given to those on board that the trial trip had commenced. At a quarter to four the "way" on the vessel was rapid; her head went round like turning a pleasure-boat; and so little sign was given of the ship being under steam, that it seemed rather as if the breakwater had got adrift and was slowly floating past, than that the monster vessel was really cleaving the blue waves with a force which, as yet, we have seen no wind or sea to resist or check. Directly the anchor was fished, Captain Harrison passed the word to steam ahead with both engines easily, and the wheels began their revolutions, slowly at first, but nevertheless making a track of foam upon the water such as they never made on the first start from Deptford to the Nore. The accession of speed from working the paddles was at first but slight; not from any want of power, however, but simply from the fact that both engines were ordered to work slowly, and though propelling the great ship at something like eleven knots, were really scarcely driving at indicated half-speed.

Quitting Portland, it was necessary to make rather a round turn on leaving the breakwater, as right ahead on the starboard bow was a small light-ship, looking like the skeleton of a vessel, and marking the presence of a dangerous shoal, known by the most appropriate and significant name of "The Shambles." Inside this lay a long and turbid ridge of angry water, where the Race of Portland ran, and where a deep rolling swell, like the Bay of Biscay on a reduced scale, kept tumbling and breaking into spray like drifts of snow against the high, gaunt cliffs. It, however, required no actual watching of the low green mounds of water, which seemed butting against the coast, to convince all on board that the *Great Eastern* was at

sea. To the infinite relief and comfort of all the passengers, the vessel began to yield to reason, and to behave as much like another ship as she could consistently with her size. It would be too much to say she rolled at this time; for when the *Great Eastern* rolls, if ever she does roll, travellers may depend upon her accomplishing something in that peculiar style of ocean navigation quite in proportion to her bulk; but one thing is certain—that she went from side to side sufficiently to show that she was susceptible of the motion of the water, and that if ever she steams across a beam sea, she is likely to move to it with a will, though slowly and easily.

Continuing for a considerable time under little more than half steam, the *Great Eastern* averaged more than thirteen knots, (fifteen miles), an hour. The best guide to the rapidity of the ship's progress was the way in which she passed fast-sailing schooners and overhauled the steamers. At this time nearly all the swell had ceased, and the monster ship was rushing over what to her were the mimic waves, and leaving less wake upon the waters than is caused in the Thames by a Gravesend boat. The only peculiarity about her progress was the three distinct lines of frothy water which the screw and paddles made, and which, stretching out in the clear moonlight like a broad highway, seemed as if the *Great Eastern* had fulfilled her purpose, and really bridged the sea.

For a considerable part of the way the paddles were working easily at from nine to ten, and the screw at from thirty-two to thirty-four revolutions per minute. It will give most readers a better idea of the tremendous nature of the size and speed of the engines which worked so easily, when it is said that, at ten revolutions, the paddle-wheels dashed through the water at something like 1600 feet per minute, and the screw revolved at 2500. When accomplishing this, the consumption of fuel

was at the rate of 250 tons a day for both engines, the indicated power being above 5000 horses—about 2000 horses for the paddles, and a little over 3500 for the screw. In order to secure her going at full speed, however, under such circumstances, the great ship should have been down by the stern at least eighteen inches more than she really was, for not less than a foot of the screw-blades was out of the water, and the slip or loss of power was of course very great. Off the coast of Cornwall, the swell caused her to roll very considerably, as long as she was a-beam of the long swell.

Soon after this a small brig was seen right under the starboard bow. As usual with these small coasters, she was showing no light and keeping no look-out, and but for the anxious vigilance exercised on board the big ship, the brig would have been under the waves in two minutes more. Her escape was narrow enough, and nothing short of the instant stoppage of the engines and actually reversing the screw saved her from swift destruction. She drifted from under the starboard paddle within twenty yards—quite close enough to enable Captain Harrison to speak to her master, and to express a very strong opinion on his style of navigation and conduct generally.

Towards the close of the trip all the fore and aft sails were set. The look of her vast spread of canvas and the extraordinary effect it produced, as one stood at the wheel-house and gazed beneath the long vista of brown sails stretched to the very utmost, and sending off the wind with the sustained roar of a volcano, was something almost indescribable. No mere description could convey a fair idea of the curious effect of the long, unbroken avenue of masts, sails, and funnels,—like a whole street of steamships, if such a term is fairly applicable.

The rate of going throughout the whole trip was very satisfactory. Allowing for the want of trim on the part of the vessel, and consequent absence of immersion in both screw and paddles, it was calculated from this data, by all the nautical authorities on board, that, in proper condition, the vessel might be depended on for eighteen miles an hour throughout a long voyage, and under steam alone. That in a strong and favourable breeze she would at times accomplish eighteen knots, or more than twenty-one miles an hour, there was no reason to doubt.

Among other tests to which the *Great Eastern* was subjected was the terrible storm of the 25th and 26th October of that year, (1859), in which the *Royal Charter* went down. She lay at anchor in the harbour of Holyhead during that storm. So fierce was the gale that a large part of the breakwater was destroyed, and several vessels went down inside the harbour, while some were driven on shore. For one hour the big ship was as near destruction as she is ever likely to be. Her salvation, under God, was due to the experience and energy of Captain Harrison and his officers. During the whole gale the captain was on the watch, sounding the lead to see if she dragged, and keeping the steam up to be in readiness to put to sea at a moment's notice. The gale roared and whistled through the rigging with indescribable fury. The captain, in trying to pass along the deck, was thrown down, and his waterproof coat was blown to ribbons. The cabin skylights were thrown open with a fearful crash, the glass broken, and deluges of rain and spray poured into the saloons. Two anchors were down, one seven tons, the other three, with eighty and sixty fathoms of chain respectively; but the ground was known to be bad, and the lee-shore rocky, while the waves came curling and writhing into harbour, straining the cables to the utmost, and dashing against the rocks like avalanches of snow. The dash of these billows on the breakwater was like the roar of artillery.

All this time the red light at the end of the breakwater shone out cheerily in the midst of a turmoil of spray. At last masses of the timber-work and solid masonry gave way. The gale rose to its fiercest, and one huge billow came rolling in; it towered high above the breakwater; it fell, and the red light was seen no more. The danger was now imminent. The cables could evidently bear no more, and the gale was increasing; so the screw was set going, but the wreck of timber from the breakwater fouled it and brought it to a dead-lock. Then the wind veered round more to the north-east, sending a tremendous swell into the harbour, and the *Great Eastern* began to roll heavily. In this extremity the paddle engines were set going, and the ship was brought up to her anchors, one of which was raised for the purpose of being dropped in a better position. At this moment the cable of the other anchor parted, and the great ship drifted swiftly toward what seemed certain destruction; but the heavy anchor was let go, and the engines turned on full speed. She swung round head to wind, and was brought up. This was the turning-point. The gale slowly abated, and the *Great Eastern* was saved, while all round her the shores and harbour were strewn with wrecks.

After the gale the *Great Eastern* started on her return trip to Southampton, which she reached in safety on the morning of the 3rd November. In this, as in her previous experiences, the mighty ship was well tested, and her good and bad points in some degree proved. At the very outset the steam gear for aiding in lifting the anchors broke down, and one of the anchors refusing to let go, was broken in half. The condenser of the paddle engines seems to have been proved too small in this trip. For some time she went against a stiff head-wind and sea—which is now well known to be the great ship's forte—with perfect steadiness; but on getting into the channel she rolled slowly but decidedly, as if bowing—acknowledging

majestically the might of the Atlantic's genuine swell. Here, too, a wave actually overtopped her towering hull, and sent a mass of *green* water inboard! But her roll was peculiarly her own, and wonderfully easy.

The vessel made eighteen knots an hour. She was under perfect command, even in narrow and intricate channels, and, despite her varied mishaps and trials, passed through this stormy period of her infancy with credit.

Disaster to "Great Eastern" in September 1861.—Having made three successful voyages to America, the Great Eastern, after all her troubles, was beginning to establish her reputation, to confirm the hopes of her friends and silence the cavils of her enemies, when the bad fortune that has been her portion from the cradle once more overwhelmed her, and shook, if it did not altogether destroy, the confidence in her capabilities which the public had been beginning tardily to entertain.

There is nothing more difficult to ascertain than the true state of the case—with reference to culpability, accidental circumstance, inherent or incidental weakness, negligence, unavoidable risks, etcetera—in such a disaster as that which happened to the great ship in September of 1861. And nothing could be more unfair than to pass judgment on her without a full knowledge of the minute particulars, and, moreover, a pretty fair capacity to understand such details and their various relations. Before proceeding with the narrative of the event referred to, we may remark that while, on the one hand, it may be argued, with great plausibility, that her numerous disasters and misfortunes prove that she is unfitted for the navigation of the sea, it may, on the other hand, be argued, with equal plausibility, that the very fact of her having come through such appalling trials unconquered,

though buffeted, is strong presumptive evidence that she is eminently fitted for her work, and that, under ordinary circumstances and *proper* management, she would do it well. It is believed that any other vessel afloat would have been sunk had she been exposed to the same storm *under similar circumstances*. It must be borne in mind that, although other vessels weathered the same storm successfully, they did not do so with their rudder and rudder-posts gone, their captains and part of their crews new to them, and their chain cables, cabin furniture, and other material left as totally unsecured as if she had been a river steamer about to start on a few hours' trip.

On Tuesday the 10th of September the *Great Eastern* left Liverpool for America with 400 passengers and a large, though not a full, general cargo. Between 100 and 200 of the passengers occupied the berths in the principal cabins; the remainder of them occupied the intermediate and steerage cabins.

All went on prosperously until the Thursday, when, as the ship was in full steam and sail, she encountered a terrific gale about 280 miles to the west of Cape Clear, and, in spite of the best seamanship, she failed to ride over the storm, which, with tremendous fury, swept away both her paddles. Simultaneously the top of the rudder-post, a bar of iron ten inches in diameter, was suddenly wrenched off, and her steering gear being also carried away, she broached to and lay like a huge log in the trough of the sea. From Thursday evening until two o'clock on Sunday, her bulwarks almost touching the water, she rolled about like a disabled hulk, the passengers and crew expecting that she would every moment go down. The working and rolling of the vessel, at one instant of dread, displaced and destroyed all the furniture of the cabin and saloons, and, broke it to pieces, throwing the passengers pell-mell about the cabin. Everything that occupied the upper deck was

washed away, and a large part of the passengers' luggage was destroyed. Between twenty and thirty of those who were on board, including several ladies, had limbs and ribs fractured, with numerous cuts and bruises. One of the cow-sheds, with two cows in it, was washed into the ladies' cabin, together with other things on board, and caused indescribable consternation and confusion.

On Sunday evening, after two days of terrible suspense, a temporary steering gear was fitted up, and the disabled vessel with her distressed crew made for Cork Harbour, steaming with her screw at nine knots an hour. Her flag of distress was sighted at about three o'clock in the afternoon of Tuesday, off the Old Head of Kinsale, and H.M. ship *Advice* at once steamed out to her assistance and towed her to within a mile of the lighthouse off Cork Harbour by about nine o'clock.

Such is a general outline of this disaster—one which is rendered all the more remarkable from the circumstance that the vessel had only been recently surveyed by the officers of the marine department of the Board of Trade, when new decks and other requirements were carried out and completed at a cost of 15,000 pounds.

The scene during the storm in the grand saloon, as described in detail by various passengers, was absolutely terrific. None of the furniture had been secured, and when the gale became violent and the rolling of the vessel increased, sideboards, tables, chairs, stools, crockery, sofas, and passengers were hurled with fearful violence from side to side in a promiscuous heap. When it is said that at each roll the top platform of the paddle-boxes dipped into the sea, anyone who has seen the towering sides of the *Great Eastern* may form some conception of the angle of the decks, and the riot of unfastened articles that continued below during the greater

part of the gale. The destruction was universal. The largest mirror in the grand saloon, which was about twelve feet high, was smashed to pieces by a gentleman going head foremost into it. Although much bruised and cut, strange to say he was not seriously injured. The chandeliers fell from the ceiling, and the crashes they made in falling added to the general din. One of the other mirrors was smashed by a large stove. Some of the passengers escaping from the dining-room were dashed against the iron balconies, which gave way with the pressure, and falling on the glass flooring at the sides, dashed it to atoms. The noise and turmoil of destruction below, together with the howling of the tempest above and the dashing of spray over the decks, whence it flowed in copious streams down into the cabins, formed a scene which cannot be fully conceived except by those who witnessed it.

On deck, the confusion was equally great and destructive. Many of the boats were carried away. The great chain cables rolled from side to side, until they were actually polished bright by the friction, while they were a source of perpetual danger to the crew in the performance of their duties. The oil-tanks broke loose, and after tumbling about for a time, fell down through the upper hatchway. And the two cows that fell with their cow-shed down into the ladies' cabin were killed by the violence of the shock. The chief cook was flung against one of the paddle-boxes, and having put out his hand to save himself, had his wrist sprained. He was then flung towards the other side, and coming against a stanchion in the way, had his leg fractured in three places. One lady had a rib fractured; another her shoulder dislocated; another her wrist. These are only specimens, selected to show what the poor people were subjected to. It is said that there were twenty-two fractures altogether, among passengers and crew, besides innumerable cuts and bruises. The cabins were flooded to the depth of several feet, and broken articles of

furniture floated about everywhere. The luggage in the luggage-room, which had not been secured, was hurled about, until trunks, boxes, valises, etcetera, striking against each other, and against the sides of the compartment, were utterly destroyed—the very leather of the trunks being torn into small shreds.

Throughout all this terrible scene, the passengers behaved, with one or two exceptions, admirably. The ladies especially displayed great courage—remaining, in accordance with the desires intimated to them, in their cabins; while the gentlemen did their best to keep order. On the Friday, they appointed a sort of committee or police force, of upwards of twenty strong, who took the duty in turns of going round the vessel, keeping order, carrying information to, and reassuring, the ladies and children. Four only of these, who were called directors, had the privilege of speaking to the captain during the storm—thus saving him from the annoyance of repeated and ceaseless questioning.

The crew also did their duty nobly. Captain Walker acted throughout with calmness, courage, and good judgment; and from the tenor of resolutions passed at an indignation meeting, held by the passengers after their return into port, it would appear that they entirely exonerated him from any blame in reference to the disaster. The fitting up of temporary steering gear, which was begun on the Sunday when the storm moderated, was a work of great difficulty and danger. It was accomplished chiefly through the courage and cleverness of two men—John Carroll and Patrick Grant—who volunteered for it, and were let down over the stern at the imminent risk of their lives; and an American gentleman, Mr Towle, a civil engineer, rendered great assistance in superintending and directing the work.

It was not until two o'clock on Sunday morning that the vessel got up steam in her

screw boilers, and steered for Cork Harbour. The whole of the ironwork of both paddle-wheels was carried entirely away. The ladder leading up to the larboard paddle-box was twisted in an extraordinary manner. The boats on the starboard side were all gone, and those on the other side were hanging loosely from their fastenings. Altogether, the great ship presented a most melancholy spectacle as she was towed into port.

At the meeting of the passengers already referred to, the first resolution was expressive of their grateful acknowledgments to Almighty God for his kind care in protecting them during the storm, and bringing them in safety out of their danger. The second condemned the directors, and stated that "the *Great Eastern* was sent to sea thoroughly unprepared to face the storms which everyone must expect to meet with in crossing the Atlantic; and that, if it had not been for the extraordinary strength of the hull, and the skill which was manifested in the construction of the vessel and its engines, in all human probability every soul on board would have perished."

It has been said that if the ship had been more deeply laden she would have weathered the gale more easily. This, if true, is an argument in her favour. But in viewing the whole circumstances of this and previous disasters, we cannot avoid being deeply impressed with the fact that the *Great Eastern had not up to that time had fair play.* In her construction and general arrangements there have been some grave, and numerous more or less trivial errors. From first to last there has been a good deal of gross mismanagement; but the *Great Eastern* cannot, with justice, be pronounced a failure. Latterly she has done good service in laying ocean telegraph-cables, a species of work for which she is pre-eminently well adapted. It is possible that she may yet live to ride out many a wild Atlantic storm, and

perchance become the first of a race of ponderous giants who shall yet walk the deep,—to the utter confusion of timid croakers, and to the immense advantage of the world.

Chapter Fifteen.

Curious Craft of Many Lands.

"Many men, many minds," runs the proverb. "Many nations, many ships," is almost equally true. A nation may show its individuality in the fashion of its marine architecture as much as in any other direction—as, for instance, in its national dress, dwelling-houses, food, amusements; and an ethnologist in studying a people's characteristics may do wisely not to overlook its ships and boats.

Even in Europe, where an advanced civilisation may be supposed to be slowly smoothing off national characteristics and peculiarities, and gradually blending and amalgamating diverse national customs, there still exists a considerable disparity in the marine architecture of different states; while between the ships of Europe and those of some parts of Asia the gulf is certainly broad enough, so that about the only point of resemblance between an English ironclad and a Chinese junk is, that both are manifestly better adapted for the sea than the land. We now propose describing some of the more curious craft peculiar to various nations, beginning with Europe:

The Dutch galliot is a somewhat peculiar craft to the eye of an Englishman; heavy and clumsy-looking beyond doubt, but a good sea-boat notwithstanding. The galliot looks much the same, whether you regard her from stem or from stern, both being almost equally rounded. Keel she has scarce any; her floors are flat, hull broad and deep, and rudder very wide. Hung on each side is a large lee-board, to keep her from making too much leeway. Her hull is varnished a bright yellow colour, and shines in the sun. Her bulwarks are lofty; and a wooden house is

placed aft, where the captain and his family live, and which is always kept brightly painted. This part of the ship is a remarkably snug place, comfortably furnished, and kept with the characteristic Dutch cleanliness and neatness. Forward is the caboose of the crew, a wide, low, but roomy erection.

The galliot is rigged with square sails on her mainmast, a fore and aft main-sail, a gaff mizzen and mizzen gaff top-sails, and a high bowsprit. Her sails are sometimes white, sometimes tanned. If the reader has ever chanced to enter the port of Rotterdam, he will have encountered plenty of examples of the craft we are describing; and if he did not altogether approve or admire their shape, he must at least have been struck by their remarkable cleanness and brightness. A Dutch galliot may be fifty, eighty, or even a hundred and fifty tons burden. When the Dutch build vessels of a larger size than this, they do so on very similar lines to English merchantmen, though usually somewhat broader and bluffer.

Off the coast of Portugal we meet with many different kinds of craft, of which the trading schooners differ from almost any other kind of vessel. Broad in the beam, and short in the counter, some are rounded at the stem, some nearly square. They are decked, and are from forty to one hundred tons burden. They are peculiarly rigged, having only lower masts stepped at different angles. The gaffs of the fore-sail, as well as the main-sail, can be raised to different heights. They have fore stay-sail, jib and flying jib, gaff top-sails, and a large square sail and square top-sails. On the whole, they are ungainly-looking craft in the extreme; but they are very capable sea-boats, and make voyages as far as South America.

Mr W.H.G. Kingston gives a graphic description of a Portuguese craft which it has never been our fortune to see. He calls it the Lisbon bean-pod, from its exact

resemblance to that vegetable, and affirms it to be the most curious of European craft, which we can readily believe. "Take a well-grown bean-pod," he says, "and put it on its convex edge, and then put two little sticks, one in the centre and one at the bows, raking forward, for the masts, and another in the bows, steeving up, for the bowsprit, and another astern for a boomkin or outrigger, and then you have before you the boat in question." These boats carry a lateen sail, sail very fast, and are much used on the waters of the Tagus as fishing-boats and trawlers.

Other curious craft to be met with in Europe are the scamparia and felucca of the Mediterranean, the Greek mystico and the trabacalo of the Adriatic. The gondola, than which, perhaps, nothing that floats on the waters is suggestive of more romantic and poetical associations, is so familiar to everybody from pictures, and has so often been introduced into story, song, and narratives of travel, that we shall not pause to describe it.

Passing from Europe to Africa, we note among the craft peculiar to that country the diabiah or Nile boat, a very comfortable travelling boat for warm climates. It is a large boat, and contains a house at one end, in which the passengers sleep at night, or take refuge from the sun's fierce heat by day.

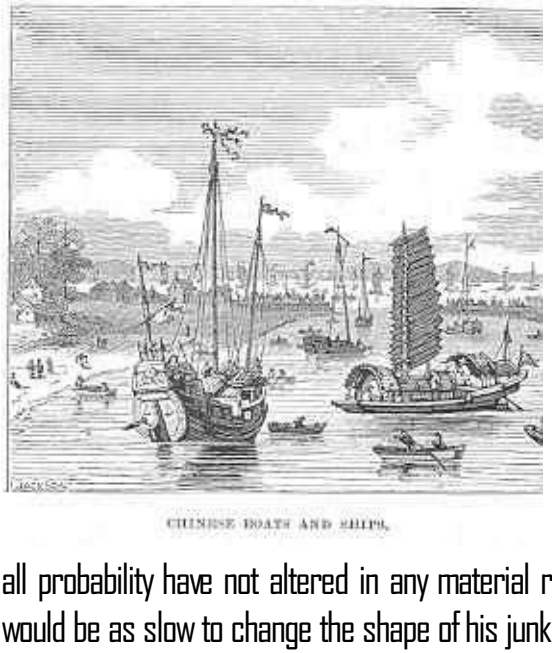
In Asia a great variety of vessels and boats of various shapes and sizes are met with, to describe all of which would carry us far beyond the space at our disposal. The dhow of the Arabs runs from sixty to a hundred tons, is almost entirely open, and has a sharp pointed bow, projecting for a considerable distance beyond the hull. On the high, broad stern a covered-in poop is placed, containing the quarters of the captain and passengers. The stern is usually ornamented with carving, as English vessels used to be in old days. The dhow carries but one sail, lateen-

shaped, and the mast stoops forward at a sharp angle. These craft have not unfrequently been engaged in the nefarious slave traffic carried on on the east coast of Africa.

The catamaran of Madras can only be called a boat on the *lucus a non lucendo* principle, for it consists simply of three logs placed side by side, pointed at the bows, and kept together by two cross-pieces. Yet this rude raft does good service in its way, being the only means of communication in rough weather between vessels lying off Madras and the shore; for there are no wharves at Madras, and ships are compelled to anchor in the offing. When the sea runs so high that boats of the ordinary kind are useless, the services of the catamarans are gladly enough made use of.

The native boatmen, seated on their log rafts, and quite naked, make their way through the roughest surf to the vessels, carrying messages to and from the land. The rower propels his boat with a rather long paddle. Sometimes he is washed off his catamaran into the sea; but being an expert swimmer, he usually recovers his seat without much trouble, and it rarely happens that any of these men are drowned.

We spoke a little space back of the national characteristics of a people being traceable in its marine architecture as well as in other things, and surely this statement finds abundant illustration in the craft of the Chinese. In China we find an intensely conservative people, and their national bent is undoubtedly



CHINESE BOATS AND SHIPS.

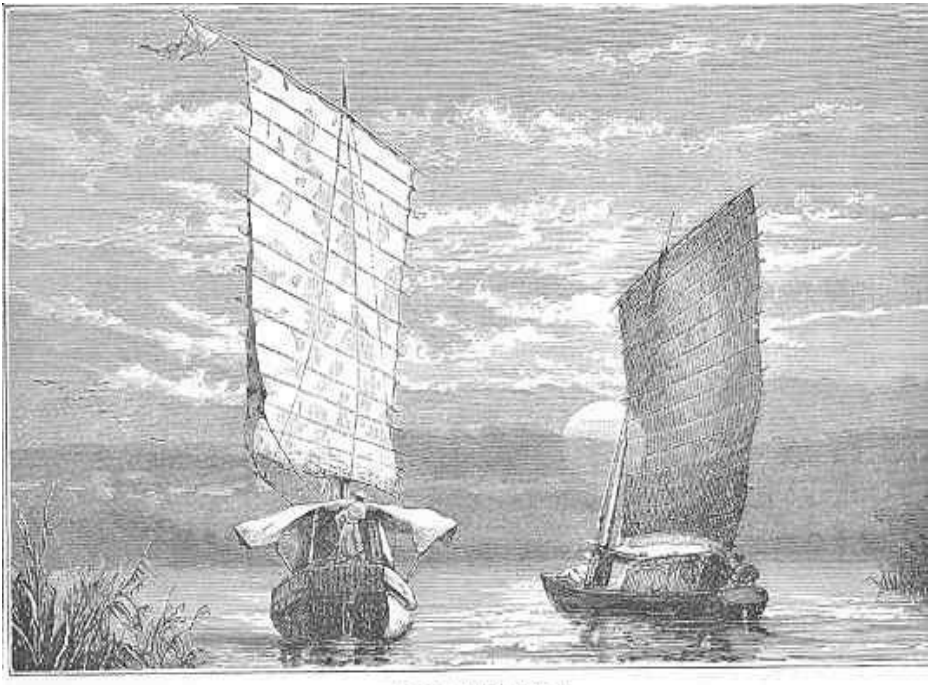
indicated in their ships, which in all probability have not altered in any material regard for centuries. A Chinaman would be as slow to change the shape of his junk as his shoes, or the length of his pigtail. And a strange, old-world, semi-barbarous look a Chinese junk has.

Chinese junks vary greatly in size, but all present the same type of architecture. The sails in every case are of brownish-yellow matting, swung across the mast like a main-sail, and having pieces of bamboo placed cross-wise and parallel to each other, making them look somewhat like venetian blinds. These wooden strips both strengthen the sail and facilitate its reefing when lowered.

A large Chinese junk rises high out of the water; there are two or more decks aft above the main-deck, painted and carved with various devices; and the cabins are often luxuriously furnished according to Celestial tastes. If you look at any representation of a junk, you will notice that the rudder is very broad, resembling somewhat the rudder of a canal barge. In spite of its primitive look, it has, after all,

something picturesque about it; but we fancy that we would rather contemplate it in a picture than sail in one across the Atlantic.

On the deck of a junk is always to be found a josshouse or temple, in front of which the crew keep incense, sticks, and perfumed paper continually burning. When a calm overtakes an English vessel, the sailors and passengers are always supposed to try what "whistling for a wind" will effect. In lieu of this method of "raising the wind," a Chinese sailor shapes little junks out of paper, and sets them afloat on the water as a propitiatory service to the divinity who has the welfare of seamen under his especial care.



CHINESE RIVER-BOATS. Page 86.

The river-life of China is very curious. Quite a large proportion of the people spend their whole lives on the water, while many who are employed during the day on land sleep in boats on the various rivers. This condition of things corresponds in some degree to that described by Captain Marryat in that fine old story "Jacob Faithful," in the early chapters of which we get diverting glimpses of life on board a Thames lighterman. But the river population of China is still more absolutely aquatic in manner of life than the Thames barge-folk. The boats in which this class of the population live have an awning of bamboo and matting fore and aft, which is removed by day and raised at night. At sundown the boat-people anchor their craft in rows to stakes, thus forming boat-terraces as it were. When business grows slack at one part of the river, the master of the boat moves up or down stream to some other part. From the shape of these boats, resembling somewhat the half of an egg cut lengthwise, they are called in the Chinese language "egg-boats." A large family will sometimes pack itself into an egg-boat not much more than twelve feet long and six broad.

These river-folk have characteristics which almost render them a people apart. They have a code of laws of their own, differing in many points from that which governs the land community, and the two populations do not intermarry. Women to a large extent navigate the egg-boats, as indeed they do many other kinds of boats in China. Travellers report that these river-families live peaceable and happy enough lives, seldom disturbed by disputes of any kind. Possibly one cause for this may be that which some humourist suggested as the reason why "birds in their little nests agree," namely, because it would be dangerous if they "fell out." But, speaking seriously, it says much for the placable nature of these Chinese river-folk that they can pass such a happy existence within the narrow bounds of their egg-

boats.

CANADIAN RIVER-STEAMER. Page 201.

Passing over to America, we shall first describe the famous American and Canadian river steamboats, which are in many respects as curious and unique as they are generally magnificent. These steamers are usually paddle-boats; are very long and narrow in shape, but of great strength. On the hull a sort of lofty platform is built, which is divided into what may be called the middle and the main deck, one above the other. Fore and aft there is a spacious, luxuriously appointed, and richly decorated saloon, covered in with a glass roof.

Ranged on each side of the saloon are the cabins, each containing two berths. These sleeping-cabins, like the saloon, are prettily furnished and tastefully

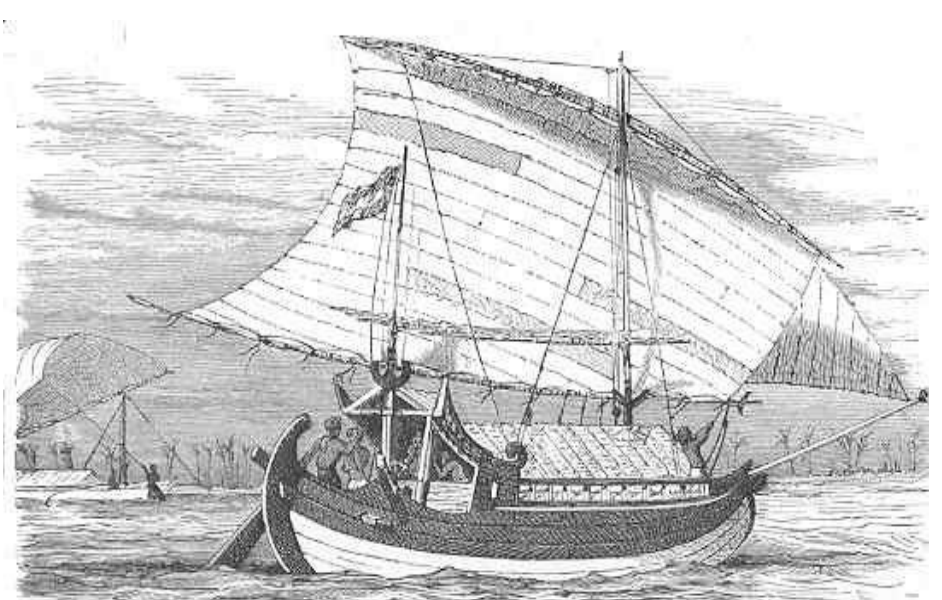
decorated. Over the saloon is another deck or platform—the whole structure as may be seen from our illustration is very much "be-decked"—about the middle of the vessel and in front of the funnel. Here is situated the wheel, and here also the captain and officers take their position. This part of the vessel is kept private to them, no passenger being permitted to trespass on it.

Beneath the saloon-deck is the middle-deck, as has already been indicated, which also contains a saloon of its own, as well as sleeping apartments. This portion of the steamer is usually reserved for the unmarried ladies among the passengers, who, as all readers of American literature must be aware, are treated in America with an almost chivalrous courtesy and consideration.

The dining-saloon of the vessel is situated in a third and undermost deck, which reaches from the middle of the boat right aft, and is a well-lighted, well-arranged room.

The cargo is placed amidships, heaped up in great piles—passenger boats seldom or never carrying heavy goods. The American's passion for economising time is manifest in the steamboats as everywhere else, most of them carrying a barber, who will accommodate you with "easy shaving" during the voyage. The barber's shop is forward with the cook's quarters and other offices. American river-boats may vary, of course, in details, but we have endeavoured to indicate the leading characteristics of a typical example. The stories current in regard to the facility with which an American steamboat blows up have been much exaggerated, but nevertheless it is probably true that they bear the bell in this direction of risk and danger.

Of all craft of the canoe order, the flying-proa of the Pacific is the swiftest. It carries a sail almost triangular in shape, and a straight yard. It has an outrigger; and outrigger, mast, and yard are of bamboo. Strong matting composes the sail, which is stretched very flat upon the yard. When the crew wish to put their boat about they have merely to shift the sail, when what was before the prow of the proa becomes the stern. These boats are usually manned by a crew of about half-a-dozen. One man sits at either end of the vessel and takes his turn of steering according to whatever tack the canoe is on. The duty of the rest is to bail out the boat and to keep the sail properly trimmed.



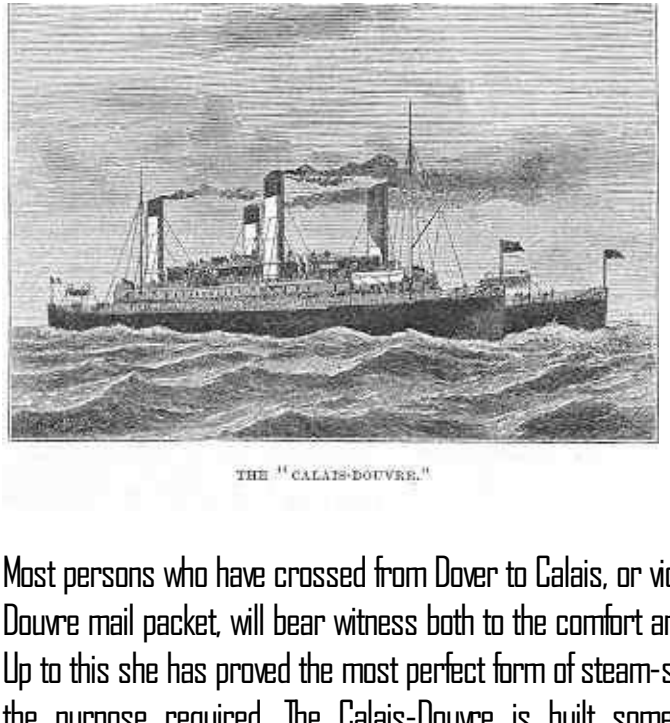
MALAY PROA.

Nothing afloat, probably, can go so close to the wind as the flying-proa, while its

speed is astonishing. The Malays use the proa, but theirs is a broader, heavier, and less swift boat than that used by the Ladrone islanders of the Pacific, which is that which we have just described.

The canoes of the Fijians are superior to those in use among any other of the South Sea islanders. Their chief feature is that they are twin-canoes, joined together by cross-beams, which support a platform of from twelve to fifteen feet broad. Of the two canoes, one is smaller than the other, and the smaller serves by way of an outrigger. These canoes are sometimes one hundred feet long, their depth being usually about seven feet. Sometimes a small cabin is built upon the platform. The mast is about thirty feet long, is supported by guys, and is furnished with a yard carrying a large sail. There are small hatchways at both ends of the craft, at each of which one of the crew sits ready to bail out the boat. The Fijian canoes can also be propelled by means of sculling, the sculler using a broad-bladed scull about ten feet in length. A large canoe can be got through the water at the rate of two or three miles an hour by sculling.

Various experiments have from time to time been made in the way of building boats and ships with double hulls, the object being to obtain increased stability, and thus reduce to a minimum the rolling and pitching of ordinary vessels. The steamship Castalia was an ambitious attempt in this direction. She was built for the passenger service between England and France. But she did not realise the expectations formed of her.



THE "CALAIS-DOUVRE."

Most persons who have crossed from Dover to Calais, or vice versa, by the Calais-Douvre mail packet, will bear witness both to the comfort and speed of that vessel. Up to this she has proved the most perfect form of steam-ship yet constructed for the purpose required. The Calais-Douvre is built somewhat upon the same principle as the Castalia, but differs from that vessel in that whereas the latter was two half-ships joined together, each twin-portion of the Calais-Douvre is a perfect ship in itself. The result has been, that while the Castalia was a failure, the Calais-Douvre has proved a distinct success. She is three hundred feet in length and sixty feet in breadth; her tonnage is two thousand, and her water-draught only six feet, so that she can enter Calais Harbour at even a low tide. Two transverse iron girder bulk-heads unite the two hulls of the vessel; and her steering apparatus is so simple, and at the same time so effective in construction, that one wheel is usually sufficient to work it. She makes the passage from Dover to Calais usually in an hour and a half; but in very fine weather we ourselves have crossed in less than that time. With the maximum rate of speed, the Calais-Douvre has attained the

minimum amount of pitching and rolling yet secured by any Channel boat. Her saloons, cabins, and decks are spacious and handsomely appointed, so that the Channel passage in this vessel is made under as favourable conditions for bad sailors as any sea-passage can be.

| Chapter 1 | | Chapter 2 | | Chapter 3 | | Chapter 4 | | Chapter 5 | | Chapter 6 | | Chapter 7 | | Chapter 8 | | Chapter 9 | | Chapter 10 | | Chapter 11 | | Chapter 12 | | Chapter 13 | | Chapter 14 | | Chapter 15 |

---

rules is very easy. You may use this eBook for nearly any purpose such as creation of derivative works, reports, performances and research. They may be modified and printed and given away--you may do
practically ANYTHING with public domain eBooks. Redistribution is subject to the trademark license, especially commercial redistribution.

*** START: FULL LICENSE ***

THE FULL PROJECT GUTENBERG LICENSE
PLEASE READ THIS BEFORE YOU DISTRIBUTE OR USE THIS WORK

To protect the Project Gutenberg-tm mission of promoting the free distribution of electronic works, by using or distributing this work (or any other work associated in any way with the phrase "Project Gutenberg"), you agree to comply with all the terms of the Full Project
Gutenberg-tm License (available with this file or online at http://gutenberg.org/license).

Section 1. General Terms of Use and Redistributing Project Gutenberg-tm
electronic works

1.A. By reading or using any part of this Project Gutenberg-tm electronic work, you indicate that you have read, understand, agree to
and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy
all copies of Project Gutenberg-tm electronic works in your possession.
If you paid a fee for obtaining a copy of or access to a Project Gutenberg-tm electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. "Project Gutenberg" is a registered trademark. It may only be used on or associated in any way with an electronic work by people

who
agree to be bound by the terms of this agreement. There are a few
things that you can do with most Project Gutenberg-tm electronic
works
even without complying with the full terms of this agreement. See
paragraph 1.C below. There are a lot of things you can do with
Project
Gutenberg-tm electronic works if you follow the terms of this
agreement
and help preserve free future access to Project Gutenberg-tm
electronic
works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation ("the
Foundation"
or PGLAF), owns a compilation copyright in the collection of Project
Gutenberg-tm electronic works. Nearly all the individual works in
the
collection are in the public domain in the United States. If an
individual work is in the public domain in the United States and you
are
located in the United States, we do not claim a right to prevent you
from
copying, distributing, performing, displaying or creating derivative
works based on the work as long as all references to Project
Gutenberg
are removed. Of course, we hope that you will support the Project
Gutenberg-tm mission of promoting free access to electronic works by
freely sharing Project Gutenberg-tm works in compliance with the
terms of
this agreement for keeping the Project Gutenberg-tm name associated
with
the work. You can easily comply with the terms of this agreement by
keeping this work in the same format with its attached full Project
Gutenberg-tm License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also
govern
what you can do with this work. Copyright laws in most countries are
in
a constant state of change. If you are outside the United States,
check
the laws of your country in addition to the terms of this agreement
before downloading, copying, displaying, performing, distributing or

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg-tm electronic works provided
that

- You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg-tm works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg-tm trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, "Information about donations to the Project Gutenberg Literary Archive Foundation."

- You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg-tm License. You must require such a user to return or
destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg-tm works.

- You provide, in accordance with paragraph 1.F.3, a full refund of any
money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.

- You comply with all other terms of this agreement for free distribution of Project Gutenberg-tm works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg-tm
electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from both the Project Gutenberg Literary Archive Foundation and Michael Hart, the owner of the Project Gutenberg-tm trademark. Contact the Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable
effort to identify, do copyright research on, transcribe and proofread
public domain works in creating the Project Gutenberg-tm
collection. Despite these efforts, Project Gutenberg-tm electronic
works, and the medium on which they may be stored, may contain
"Defects," such as, but not limited to, incomplete, inaccurate or
corrupt data, transcription errors, a copyright or other intellectual
property infringement, a defective or damaged disk or other medium, a
computer virus, or computer codes that damage or cannot be read by
your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the "Right
of Replacement or Refund" described in paragraph 1.F.3, the Project
Gutenberg Literary Archive Foundation, the owner of the Project
Gutenberg-tm trademark, and any other party distributing a Project
Gutenberg-tm electronic work under this agreement, disclaim all
liability to you for damages, costs and expenses, including legal
fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT
LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE
PROVIDED IN PARAGRAPH F3. YOU AGREE THAT THE FOUNDATION, THE
TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER THIS AGREEMENT WILL NOT BE
LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR
INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH
DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a
defect in this electronic work within 90 days of receiving it, you can
receive a refund of the money (if any) you paid for it by sending a
written explanation to the person you received the work from. If you
received the work on a physical medium, you must return the medium with
your written explanation. The person or entity that provided you with

the defective work may elect to provide a replacement copy in lieu of a
refund. If you received the work electronically, the person or entity
providing it to you may choose to give you a second opportunity to
receive the work electronically in lieu of a refund. If the second copy
is also defective, you may demand a refund in writing without further
opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth
in paragraph 1.F.3, this work is provided to you 'AS-IS' WITH NO OTHER
WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO
WARRANTIES OF MERCHANTIBILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied
warranties or the exclusion or limitation of certain types of damages.
If any disclaimer or limitation set forth in this agreement violates the
law of the state applicable to this agreement, the agreement shall be
interpreted to make the maximum disclaimer or limitation permitted by
the applicable state law. The invalidity or unenforceability of any
provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the
trademark owner, any agent or employee of the Foundation, anyone
providing copies of Project Gutenberg-tm electronic works in accordance
with this agreement, and any volunteers associated with the production,
promotion and distribution of Project Gutenberg-tm electronic works,
harmless from all liability, costs and expenses, including legal fees,
that arise directly or indirectly from any of the following which you do
or cause to occur: (a) distribution of this or any Project

Gutenberg-tm
work, (b) alteration, modification, or additions or deletions to any Project Gutenberg-tm work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg-tm

Project Gutenberg-tm is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers
including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the assistance they need, is critical to reaching Project Gutenberg-tm's goals and ensuring that the Project Gutenberg-tm collection will remain freely available for generations to come. In 2001, the Project
Gutenberg Literary Archive Foundation was created to provide a secure
and permanent future for Project Gutenberg-tm and future generations.
To learn more about the Project Gutenberg Literary Archive Foundation
and how your efforts and donations can help, see Sections 3 and 4 and the Foundation web page at http://www.pglaf.org.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non profit 501(c)(3) educational corporation organized under the laws of the state of Mississippi and granted tax exempt status by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Its 501(c)(3) letter is posted at http://pglaf.org/fundraising. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's principal office is located at 4557 Melan Dr. S. Fairbanks, AK, 99712., but its volunteers and employees are scattered

throughout numerous locations. Its business office is located at 809 North 1500 West, Salt Lake City, UT 84116, (801) 596-1887, email business@pglaf.org. Email contact links and up to date contact information can be found at the Foundation's web site and official page at http://pglaf.org

For additional contact information:
Dr. Gregory B. Newby
Chief Executive and Director
gbnewby@pglaf.org

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg-tm depends upon and cannot survive without wide spread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be
freely distributed in machine readable form accessible by the widest array of equipment including outdated equipment. Many small donations
($1 to $5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up
with these requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit http://pglaf.org

While we cannot and do not solicit contributions from states where we
have not met the solicitation requirements, we know of no prohibition
against accepting unsolicited donations from donors in such states who
approach us with offers to donate.

International donations are gratefully accepted, but we cannot make

any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg Web pages for current donation methods and addresses. Donations are accepted in a number of other ways including checks, online payments and credit card donations. To donate, please visit: http://pglaf.org/donate

Section 5. General Information About Project Gutenberg-tm electronic works.

Professor Michael S. Hart is the originator of the Project Gutenberg-tm
concept of a library of electronic works that could be freely shared with anyone. For thirty years, he produced and distributed Project Gutenberg-tm eBooks with only a loose network of volunteer support.

Project Gutenberg-tm eBooks are often created from several printed editions, all of which are confirmed as Public Domain in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our Web site which has the main PG search facility:

http://www.gutenberg.org

This Web site includes information about Project Gutenberg-tm, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.