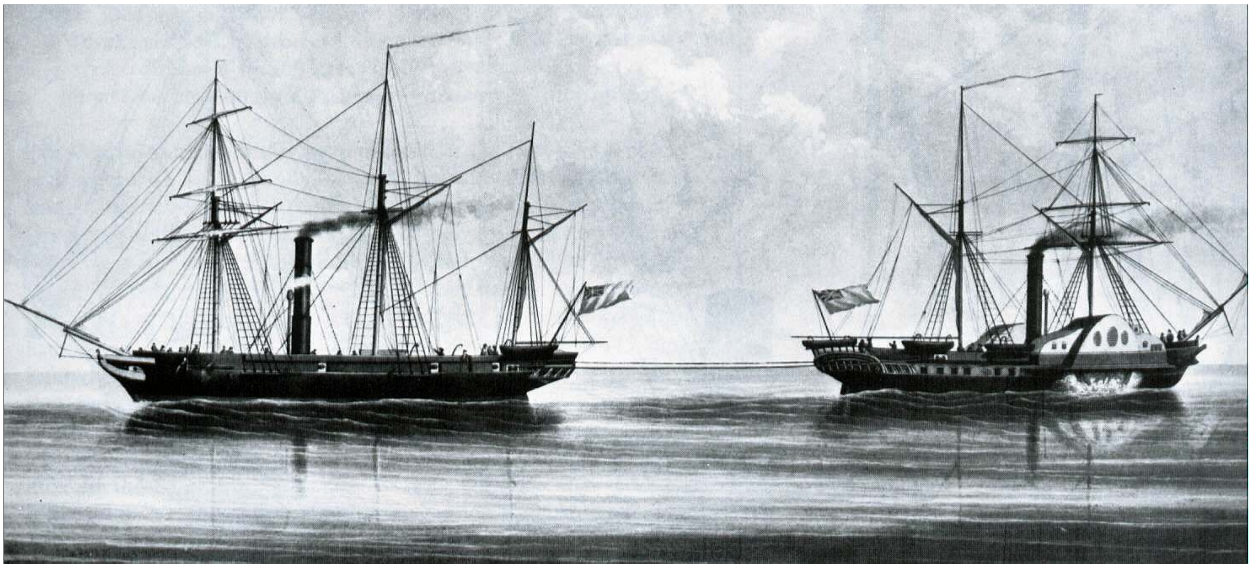
# THE SAIL & THE PADDLE
# PART II



The tug-of-war between the screw-driven *Rattler* (left) and *Alecto* (right) was more of an exhibition to convince public opinion than a scientific test, as the Royal Navy had already ordered seven screw driven ships by March 1845.

So far as the merchant ship was concerned, the propeller was almost universally recognised as the most efficient mans of ship propulsion, but the warship in general remained wedded to sail. This was to some extent understandable, particularly in Britain, which had emerged from the last great war as undisputed master of all the oceans. She still maintained the largest fighting fleet in the world, and the officers and men who had manned that navy in war were still serving in it. A radical change from wood and sail to iron and steam meant starting the navy again from scratch, with the present superiority of numbers wiped out at a stroke. But with the invention of the propeller the overriding objection to steam propulsion in warships, the vulnerable paddlewheel, had been removed , and the steam engine at last had to be admitted into naval ships.

But it was not admitted without a struggle by traditionalists, and there was still much argument in naval circles in all countries as to weather the propeller was really superior to the paddlewheel. The argument was finally settled in 1845, when two virtually identical frigates of 880 tons, H.M.S. *Rattler* and H.M.S. *Alecto*, were both fitted with engines of 220 horsepower, that in H.M.S. *Rattler* driving a propeller and that in H.M.S. *Alecto* a pair of paddlewheels. In March of that year the two ships had a race over 100 miles which the Rattler won by several miles. In a later test, the two ships, tied together with a towing hawser, set off under full engine power in opposite directions. The *Rattler* with her propeller towed the *Alecto* stern first at a speed of 2.7 knots - conclusive proof that a propeller not only drove a ship faster, but also exerted considerably more power.

So wooden warships, or at least those of Britain, were fitted with steam engines, although they still retained their full complement of masts and sails. The installation was achieved by bringing the ships into drydock, cutting them in half, and lengthening them to accommodate engines and boilers. But, whereas, in the merchant ship, masts and sails were fitted as an auxiliary source of propulsion, for use if the engine failed, in the warship it was the engine that was an auxiliary source of power, for use if the wind were blowing in the wrong direction. In France, the only other nation with a comparable navy, the adoption of the steam engine, even as an auxiliary source of power, progressed much more slowly. By 1854, only nine years after the *Rattler-Alecto* trials, the entire British fleet sent into the Baltic at the start of the Crimean War was fitted with engines; the entire French fleet in the Baltic still relied entirely on sail.

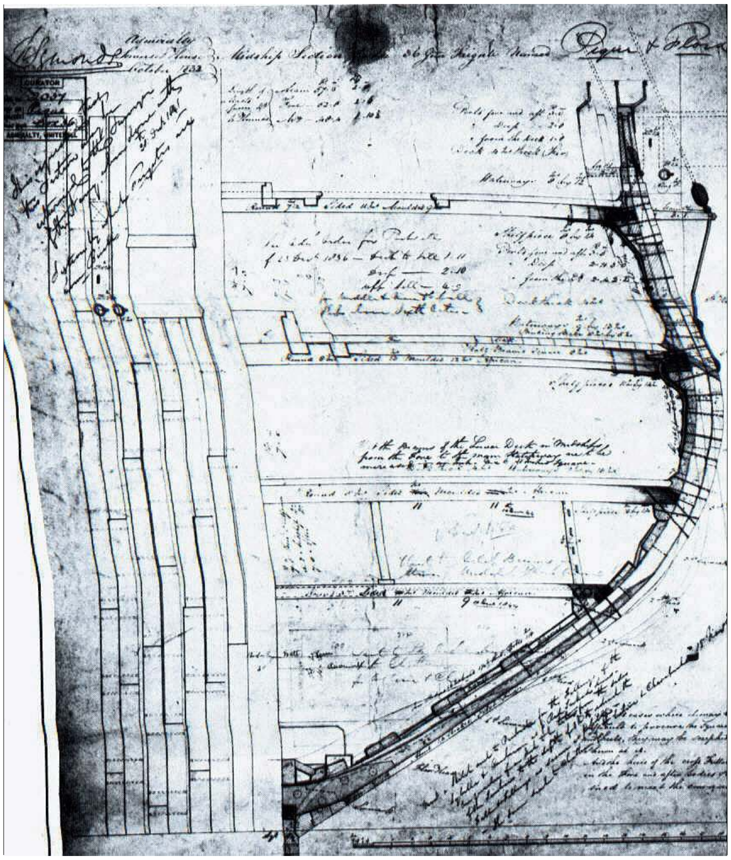
Although the propeller had emerged as the best means of transforming engine power into motion through the water, one problem remained unsolved. The fitting of a propeller entailed making a hole for the shaft in the ship's sternpost, and technology could not yet ensure watertight fitting. There were cases where ships leaked so badly through their stern gland that they had to be beached to save them from sinking. (Wooden-hulled ships faced an additional hazard. Since the vibration of the propeller could shake the sternpost to such an extent that the seams of the planking near the stern opened up and let the sea in.) It was not until 1854 that this particular problem was solved by John Penn, an engineer whose marine steam engines were widely used in ships. Penn discovered that *lignum vitae*, the hard, smooth wood of the guaiacum tree, which grows in the West Indies and has self-lubricating properties, was ideal for the purpose of lining stern glands. It also suffered very little wear as the propeller shaft revolved inside it. It was used for lining stern glands for the next forty years, until the more modern metallic packings were introduced.

It has been mentioned earlier that, in general, navies were slow to implement the advances in shipbuilding which the first half of the century brought, but this does not mean that no improvements in naval shipbuilding were made. The best wooden warships were still those built by France, mainly because, with the exception of the United States, she built appreciably larger than other maritime nations. As late as 1845 the British laid down a 74-gun ship of the line on the exact model of a French ship which they had captured in 1794, so great was their belief in the superiority of French design. But in the meantime the Royal Navy had found a naval architect of genius. As a commander, William Symonds had been given permission by the British Admiralty in 1825 to build a corvette to his own design, and the resulting ship, *Columbine*, of 18 guns, was so outstandingly successful that Symonds was promoted. His success as a designer might have ended there had not the Duke of Portland given him a commission to build a yacht. Named *Pantaloon*, she was such a success that she, too, was purchased for the navy and adapted as a 10-gun brig. Symonds was then instructed by the Admiralty to design more ships,

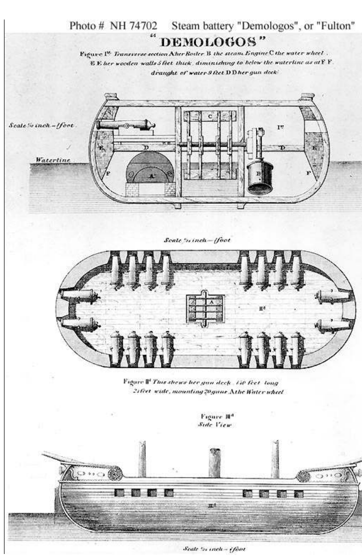
Corvettes

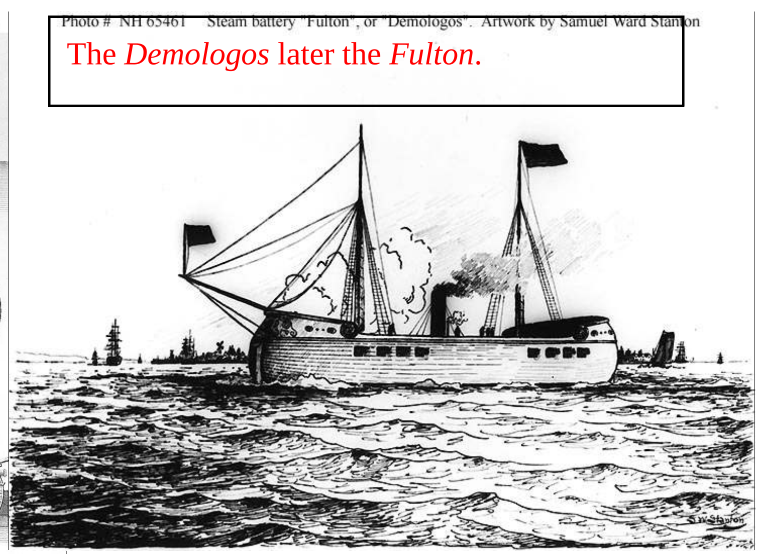
including a fourth-rate of 50 guns, and their general excellence resulted in his being knighted and made Surveyor of the Navy, responsible for all warship design. Within the next fifteen years he was responsible for the design of more than 180 warships.

Symonds's designs owed their great success not only to improved methods of construction, which brought a great increase in structural strength, but also to an improved underwater shape, much less full and heavy than had been previously the case. To some extent he followed the French lead in building large, not so much in overall length as in beam and depth, so that his ships, though shorter than the French, were broader, roomier, and higher between decks. The loss of speed which a shorter overall length might have incurred was more than made up for by the improvement in shape of bottom, which gave his ships a much cleaner run through the water. Another of his improvements was the introduction of a system for standard sizes for masts and yards, so that they became interchangeable, not only between ships of the same class, but also between ships of different classes, 'though not of course for the same purpose. Thus, for example, the topsail yards of a second-rate ship of the line were cut to the same size as



The midships section of the 36-gun frigates *Pique* and *Flora* - sister ships built to the same plan (1832). This is a typical 'Symondite' hull form.



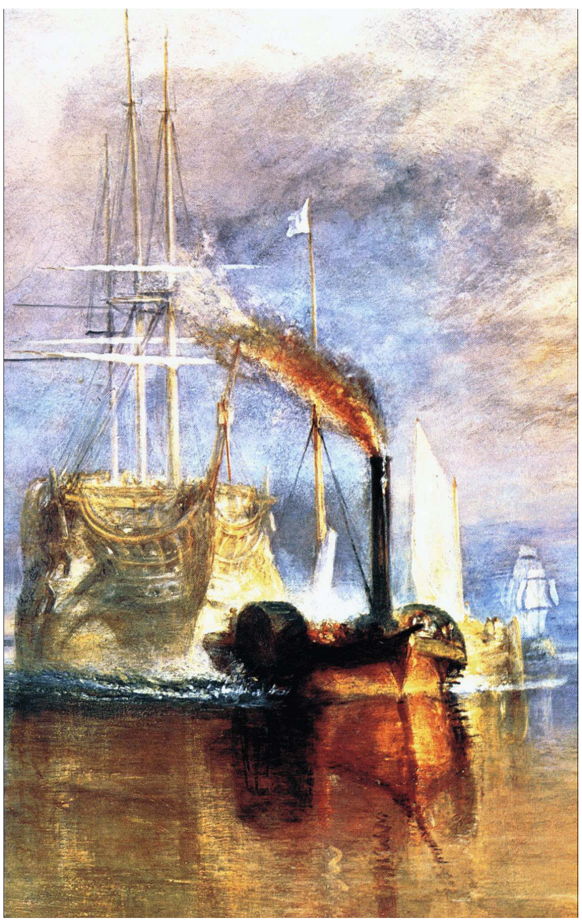




The *Demologos* later the *Fulton*.

the main yards of a frigate, and so on. By this means the eighty-eight different sizes of masts and yards maintained for the Royal Navy were reduced to twenty, with no loss of efficiency.

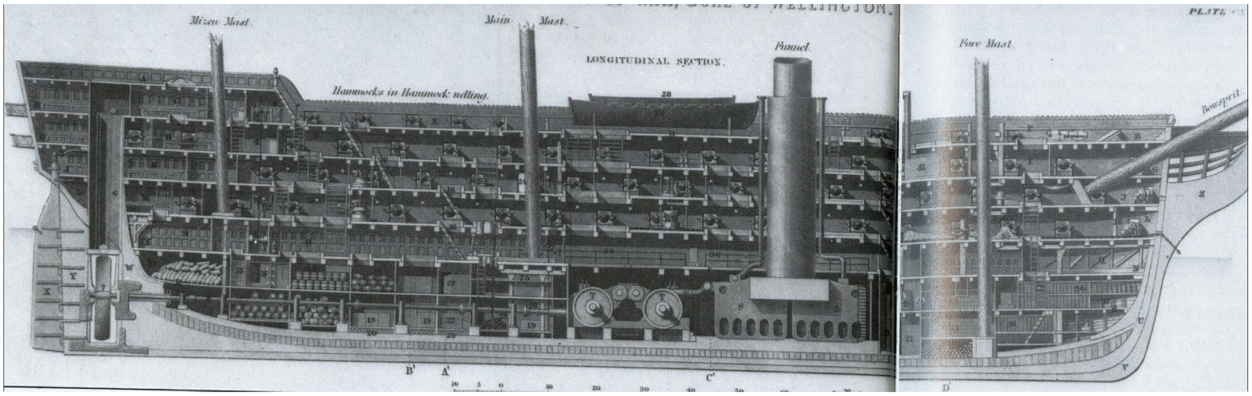
Although, in general, the fighting navies of the world turned their backs on the revolution in shipping brought about by the introduction of the steam engine, there were some small exceptions. The young United States Navy led the way with the *Demologos*, [above] launched in 1814, but completed too late to take part in the war then being fought against Britain. Designed by Robert Fulton (later she was renamed *Fulton*), she was a queer-looking vessel with two wooden hulls abreast, in one of which was the engine and in the other a boiler, and a paddlewheel mounted between them. She carried an armament of 30 guns designed to fire red-hot shot. She finally blew up in a dockyard explosion.

Britain adopted steam for her navy only reluctantly and, at first, purely for auxiliary services. It was Brunel who at last talked the Lords of the Admiralty out of their ultra-conservative attitude, and in 1822 the *Comet*, a wooden paddle steamer of 238 tons equipped with a Boulton and Watt engine of 90 horsepower, was built by contractors in the dockyard at Deptford. She was joined later by the *Monkey*, a similar paddle steamer of 212 tons, which had been built commercially at Rotherhithe and was purchased into the navy. The two vessels were used solely to tow the sailing men-of-war out of harbour when the direction of the wind made it impossible to sail out. In fact, the British Admiralty carried its disapproval of the steam engine to the extent in the official Navy List, and requiring the contractors who built the ships to supply engineers with them.



Turner's *Fighting Temeraire tugged to her Last Berth to be Broken Up* is a fitting contrast between the old and the new. During the Crimean War steamers had to stand-by to tow the lumbering three-deckers in and out of action.

France, Russia and Italy followed the naval lead of Britain by building or acquiring small steam vessels for use with their navies as auxiliaries, but, since in the world strategic situation their navies were of less account than that of Britain, they could afford to experiment. Naturally, their experiments produced nothing revolutionary in the naval sphere; in general they were, like Britain, reluctant to tinker with their capital ships until they knew that they could be sure of the effect. Nevertheless, in Britain, the Surveyor of the Navy was instructed in 1832 to design a steamship, the first to be built in Britain in a naval dockyard by naval personnel. She was the *Gulnare* of 306 tons, mounting three guns, built of wood with paddlewheel propulsion. She was followed by other small steam gunboats, but until 1840 none were built above 1,000 tons, or with anything but a small armament.  As they drew very little water, less than 5 ft. they were thought to have a naval use for inshore bombardment purposes, the risk of damage to their paddlewheels by enemy gunfire being accepted.



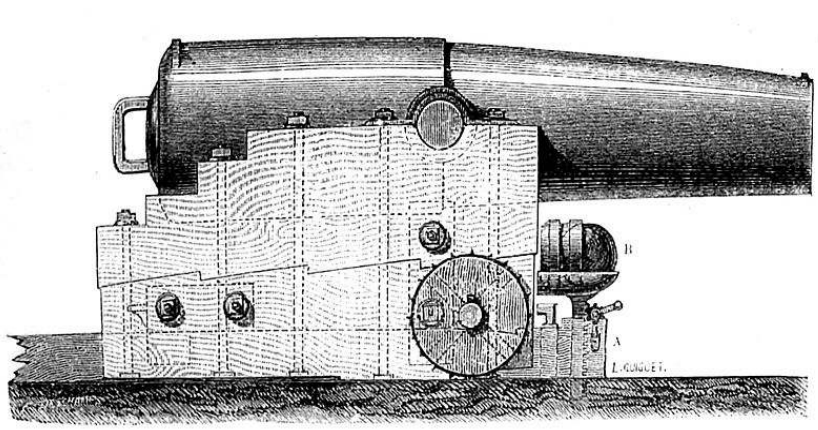

Inboard profile of the 131-gun 1st rate *Duke of Wellington* (1852).  The addition of a propeller and machinery to a three-decker's hull made for cramped conditions between decks.

Not all British naval officers were as reluctant as the Board of Admiralty in London to face the implications of the marine steam engine, and in 1825 Lord Cochrane submitted a memorandum asking for 'six steam vessels, having each two guns in the bow and perhaps two in the stern, not less that 68-pounder long guns'.  Such a squadron would have proved a formidable weapon against fleets of sailing men-of-war, and if built might well have speeded up the change-over from the sailing to the steam navy, which in fact took another half century.  Only one of the six, the *Perseverance*, was built, and not for the British navy, but for the Greek.  She played a useful, if fairly unspectacular, part in the Greek War of Independence against Turkey.

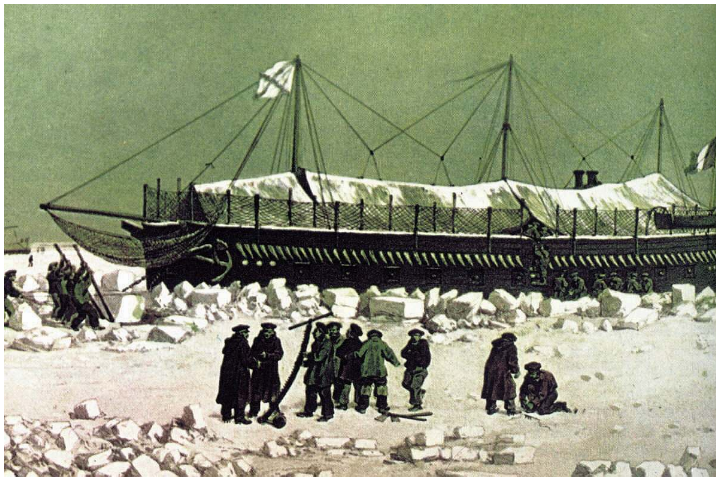
Iron did not enter into the Royal Navy's calculations until 1840, when the Admiralty purchased the iron-hulled steam packet *Dover* for no very clear purpose.  No trials were carried out with her, and she was not used with the fleet.  In the same year, three small iron gunboats were built, each mounting 2 guns, and with paddlewheel propulsion.  But they were not followed up with anything larger, even though the way had been shown by John Laird, the Birkenhead shipbuilder, who had designed and built an iron frigate which he offered to the British Admiralty.  (On the refusal of the Admiralty even to consider the purchase, she was sold to the Mexican navy.)

Yet the time was coming when the force of public opinion, particularly that of the shipping companies, would drive the Admiralty to begin using iron for warships larger than small gunboats.  Orders were placed in 1846 for three iron steam frigates of 1,400 tons, the *Birkenhead*, *Simoon* and *Megaera*, the first fitted with paddlewheels and the other two with propellers.  They never made it as warships, for gunnery experiments with an iron hull indicated that iron was still liable to break up and fracture when hit with solid shot, and the three were completed as troopships.  (The *Birkenhead's* tragic end off Danger Point, between Simonstown and Cape Town, in February 1852 is still well remembered.)

So it was back to the wooden hull for the British navy, even though some other navies were persevering with iron, backed with a thick lining of teak or oak to provide additional resistance against damage by solid shot.  In Britain, the wooden ships of the line continued to be brought into the dockyards to be lengthened to take an engine and propeller, even the oldest ships being converted to steam.  The *Ajax* and *Horatio*, both launched as long ago as 1809 and thus relics of the Napoleonic War, were two of the oldest; another was the *Nelson*, launched in 1814. The first British wooden ship of the line to be designed from the start to incorporate an engine and propeller was the 80-gun second-rate *Agamemnon*, laid down at Woolwich in 1849 and launched in 1852.  But in every case, except for that of the smallest vessels, a British warship converted to steam still retained her full complement of masts, yards, and sails as her main means of propulsion.  Her engine was a very secondary affair, and elaborate and time consuming arrangements were made to enable the propeller to be raised out of the water whenever she was to use her sails, in order to eliminate the drag exerted by the screw and retain the ship's sailing performance.  It was not until 1861 that the lifting propeller was abandoned in the Royal Navy. It was no sudden change of heart about the properties of iron that in the end forced every navy in the world to drop the use of wood for warship building; it was the development of a new form of gun and the outcome of its first use in actual conflict that brought the change.  The naval gun during the first half of the nineteenth century remained the gun with which Nelson had won his battles - big muzzle-loading cannon, firing solid round shot.  Explosive shells, fired parabolically from mortars, were used solely for bombardment and never considered as a ship-to-ship weapon. But in 1822 a French general of artillery, Henri-Joseph Paixhans, wrote a book called *Nouvelle Force Maritime et Artilleris*, in which he advocated the firing of explosive bombs from the normal naval gun, giving them a flat trajectory instead of a parabolic one, and thus converting the explosive shell into a ship-to-ship weapon. His gun was given its first serious test in 1824, against the old, moored frigate *Pacificateur*, and proved remarkably successful.  In 1853 Paixhans' guns were used for the first time in battle, when a Russian squadron of wooden-hulled ships armed with the new French guns encountered at Sinope, in the Black Sea, a Turkish squadron of Wooden-hulled ships armed with conventional naval guns firing solid shot.  It was not just the defeat of the Turkish squadron which opened the eyes of the world's navies, but the fact that the explosive shells fired by the Russian ships set all the Turkish ships on fire and they burned down to the waterline.



The lesson of Sinope was underlined two years later at the bombardment of the Kinburn forts in the Crimea.  After Sinope the French constructed a flotilla of floating batteries, protected with iron armour, and at the Kinburn bombardment three of them, the *Devastation*, *Tonnante* and *Lave*, steamed to within 1,000 yards of a fort.  It turned out that they were relatively impervious to the Russian fire, and they emerged unscathed from a position in which any wooden-hulled



One of the French floating batteries frozen in during the winter of 1855-56 in the Black Sea, after Kinburn.

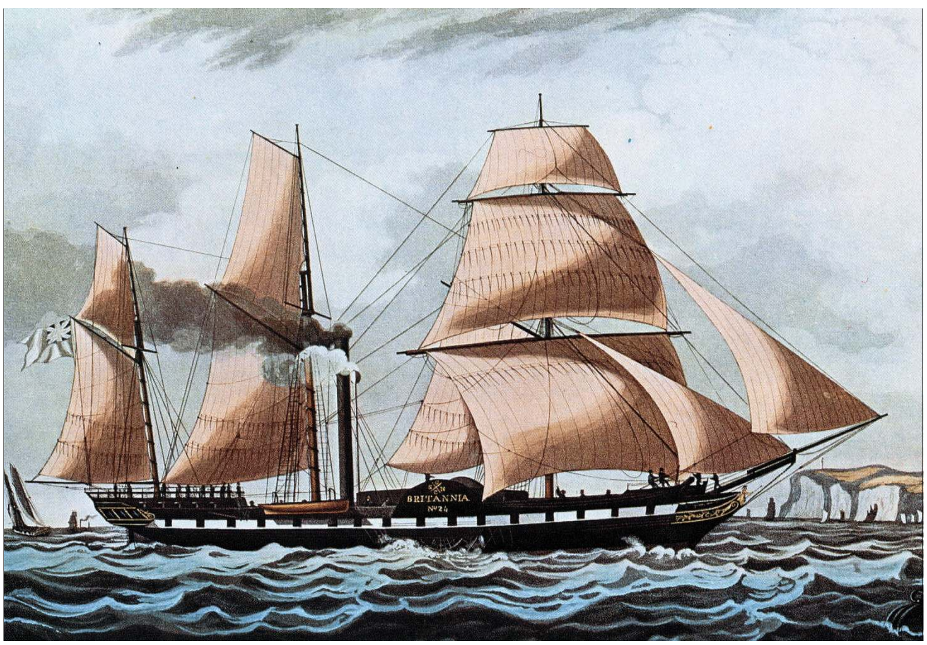
British iron-hulled armoured floating batteries.

warship in the world would have been blown to bits.
This demonstration of the advantages of iron construction in modern war conditions could not be ignored, and Britain was the first to put this experience to use by building, in 1856, the first iron-hulled armoured warships in the world - the *Terror*, *Thunderbolt,* Erebus and *Aetna*. They were designated 'armoured batteries' and built to a tonnage of 1,950, with an overall length of 108 ft., a beam of 48 ft. 6 in., and a drought of 8 ft. 10 in.. They mounted 16 smooth-bore muzzle-loading 68-pounder guns, and their 200-horsepower engines gave them a speed of 5.5 knots. It was perhaps a small beginning, but the navies of the world had learned their lesson and began to catch up with merchant navies, which had taken to iron with enthusiasm more than twenty years earlier.

Before leaving the iron warship, mention should be made of the British East India Company, which also built warships to protect and enforce their trade monopoly in India and China. It was 1839 that the Company first considered using iron for their warship hulls, and in that year they approached the Birkenhead shipbuilder John Laird to build iron warships for service in the Far East. One of these was the *Nemesis*, a ship of 660-tons, armed with two 32-pounder pivot guns (at the time an innovation in the mounting of guns, when the normal practice was to mount them on wooden carriages in broadside batteries). Although the *Nemesis* only drew 5 ft. of water she made her way out to India under her own steam via the Cape of Good Hope, and during the First China War (1841-42) was taken over by the British Navy and gave excellent service during the naval operations.

Although during the first half of the nineteenth century the world's trade was expanding fast, it was not yet at a stage where shipowners, except monopoly companies like the East India Companies, could contemplate the building of fleet of ships. It was an event in Britain that first introduced this possibility. Until 1838 the mail for overseas had been carried in Post Office 'packets' (small ships built and run by the government solely for the purpose). These were sailing ships, but by this time it was obvious that the steamship was superseding the sailing ship in the commercial sphere and that, in any service where speed and reliability were essential, the day of the sailing vessel was over. Rather than bear the cost of constructing new steamships to carry the mails, the British government decided to put the carriage out to tender by any ship-owner able to guarantee a regular steamship service that would carry the mails to their destination. The value of the contract was enough to provide the shipowner with a sound economic basis for starting a regular ferry service.

The Government offer of the transatlantic mail service attracted two bidders. One was the Great Western Railway Company, which already owned the *Great Western*, on a regular run between Bristol and New York, and had laid down a larger ship, the *Great Britain*, destined for the same service; the second bidder was a Canadian merchant from Halifax, Samuel Cunard, who owned a number of sailing ships. When the terms of the mail contract were advertised, he crossed to Britain and joined forces with Robert Napier, one of the best known marine engineers of the day, to bid for the contract. His tender for it included a clause that, if successful, he would build four ships and would guarantee to operate a regular service between Liverpool and Boston of two voyages a month, summer and winter. With his tender accepted, Cunard formed a company with the shipowners George Burns, of Glasgow, and David McIver, of Liverpool, and placed orders with Napier for four wooden paddle steamers, each with an overall length of 207-ft. and a tonnage of 1,156, and with an average speed of 8.5 knots. These were the *Acadia*, *Britannia*, *Caledonia* and *Columbia*, and they began their transatlantic service in 1840.




*Britannia*, the Cunard paddle steamer. This was the beginning of the "liner."

It proved so popular and profitable that four years later the company built the *Hibernia* and *Cambria*, both of them larger and faster than the first four. The *Hibernia*, in fact, was the first ship to cross the Atlantic in less than ten days, and was also the first to use the port of New York instead of Boston.

Four years later, with the transatlantic trade still growing, another four ships were built, each of them having a tonnage of 1,820 and a service speed of over 10 knots. So much of the trade was now coming to the Cunard Line that the United States decided to encourage their own shipowners to compete by offering their own mail carriage contract. It was given to the Collins Line, which built four new steamers of over 3,000 tons each, the *Arctic*, *Atlantic*, *Baltic* and *Pacific*, all of them with a small margin of speed over that of the Cunard ships. But though they were fine ships, Cunard replied to the challenge by building the *Africa* and *Asia*, both of around 2,000 tons, and now with twelve ships in his shipping line he was able to offer a much more frequent transatlantic service. Moreover, tragedy befell the Collins Line when the *Arctic* collided with the French steamer *Vista*, and sank with the loss of 323 lives, and when the *Pacific* sailed from Liverpool with 156 people on board and was never seen or heard of again.

In the face of these disasters the Collins Line built the *Adriatic*, larger and faster than the other Collins ships, but so expensive to build that the company went heavily into debt. And it was at this moment that Cunard unveiled his master stroke, the *Persia*. She was the first

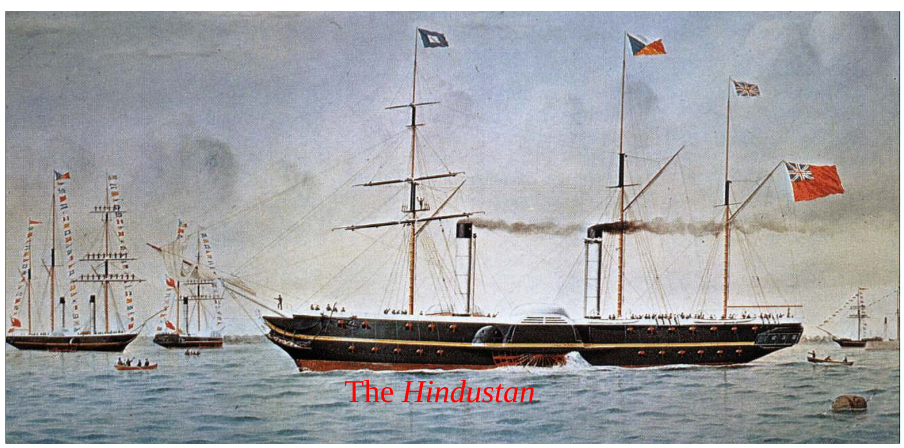
The paddle liner *Persia* (1863) gave the Cunard Line mastery of the North Atlantic. She was the biggest ship in the world for a time and also the first liner with an iron hull, but she was one of the last of the big paddle steamers.

transatlantic liner to be built with an iron hull, and at her launch was the biggest ship in the world. Her appearance on the Atlantic killed the Collins Line dead.

It was a government mail contract which gave birth to another of the great shipping lines, the Peninsula & Oriental Steam Navigation Company. It began with Robert Bourne, who had a contract for the carriage of the internal mails in Ireland, which he operated with stage coaches based on Dublin. Bourne bought a small 206-ton steamer, the *William Fawcett*, to carry the mails across the Irish Sea. The company he formed was the City of Dublin Steam Packet Company, and in 1826 he appointed two young men, Brodie Wilcox and Arthur Anderson, who ran a shipping agency, as his London agents. A second small steamer bought by the company was the *Royal Tar*, and she was used to carry cargoes to Spain and Portugal during the Spanish and Portuguese civil wars. Her reliability and regularity so impressed the Spanish government that they asked for a regular steamer service to be inaugurated and , with the British Government offering a contract to carry the mails to the Iberian Peninsula in 1837, Wilcox and Anderson formed the Peninsula Steam Navigation Company, whose first ship was the *Iberia*, a paddle steamer of 516 tons with an engine developing 180 horsepower. In 1840 the Peninsula Steam Navigation Company was offered the mail contract to Egypt and India. *Oriental* was added to the Company's name, and two more steamers, the *Oriental* of 1,674 tons and the *Great Liverpool* of 1,311 tons, were built to carry the mails through the Mediterranean to Egypt. In 1842 the Suez-Calcutta service was inaugurated by the *Hindustan*, of 2,017 tons, and in the same year the company gained the government mail contract for Australia. With this extension of their Indian route to Singapore, they were now poised to become the most powerful shipping force throughout the Far East.

The *Iberia*

There were other shipping lines starting to operate to different parts of the world around the same time, for these were the years which saw the beginning of the industrial revolution with its immense upsurge of world trade. It was the start of a golden age for shipping, and the next fifty years were to see more changes and more development in the size, design, and power of ship than had occurred during the whole of the previous 2,000 years.



The *Hindustan*