of England. She ran as a passenger boat between New York and Albany, and at the end of her second season proved too small for the crowd that thronged to take passage in her. In 1809 the “ Phoenix" made the passage from Hoboken, in New Jersey, to Philadelphia, and was thus the first steamer to make a sea voyage. In 1812 Bell began running his steamer “ Comet,” with passengers, between Glasgow, Greenock and Helensburgh : she was 42 ft. long, 11 ft. broad, 5½ ft. deep, and her engine had one cylinder 11 in. in diameter, with a 16-in. stroke. Owing to the success achieved by these and other vessels in America and Great Britain, steamers soon began to make their appearance on many of the principal rivers of the world. Early in 1814 there were five steamboats on the Thames, and the steamboat “ Margery,” built on the Clyde, was brought through the Forth and Clyde canal and round by the east coast to the Thames. In the same year a writer in the *Gentleman's Magazine* was able to say: “ Most of the principal rivers in North America are navigated by steamboats; one of them passes 2000 m. on the great river Mississippi in twenty-one days, at the rate of 5 m. an hour against the descending current.” In 1816 the first steam passenger- boat ran across the English Channel from Brighton to Havre, and a line of steamers was started to run between New York and New London. All of these vessels were built of wood; but in 1820 the first iron steamship, the “ Aaron Manby,” was constructed and employed in a direct service between London and Paris. In 1822 a return was made to the House of Commons showing the times occupied by steamers as compared with sailing vessels on some thirty coasting routes; the average speed given for steamers in the best of these was from eight to nine knots, while the average time taken varied from one-half to one-sixth (or even less) of the time taken by the sailing vessels.

Steam vessels were employed at a very early date upon the mail services, for besides being very much quicker than the sailing vessels, they were practically independent of the direction of the wind, and to a considerable extent of the weather; consequently the regularity of their passages contrasted very favourably with the irregular times kept by the sailing vessels. The mail service across the Irish Channel, between Holyhead and Dublin, was especially uncertain in the days of the sailing packets, frequently occupying three or four days, and occasionally as much as seven and nine days. All this was altered when in 1821 the steamers “ Royal Sovereign ” and “ Meteor ” were placed on the service. The advantages were so apparent that steam mail packets between Great Britain and the Continent, and on many other services, were soon established. The mail boats had been for many years owned by the crown, but in 1833 the carrying of the mails to and from the Isle of Man, and between England and Holland and Hamburg, was entrusted to private companies. Marked im­provement in the services, and especially in the boats employed, resulted from the competition to secure the distinction and other advantages of carrying His Majesty's mails. An intermediate stage followed, extending over a comparatively short period, during which the crown still held many of the mail boats, while in a considerable number of cases the mail services were let to private companies. After this the British government abandoned altogether the policy of being the owners of the boats, and the mail services have since been competed for by private companies.

The “ Savannah" was the first steamship to cross the Atlantic. She ran from Savannah to Liverpool in 1819 in twenty-five days, under steam, however, only for a portion of the time. She was built at New York as a sailing ship, but before launching was fitted with steam power, the paddle-wheels being arranged to be removed and placed on deck when not required. She was 130 ft. long, 26 ft. broad, 16½ ft. deep and of about 380 tons. The success of the“ Enterprise,” of 470 tons, which made the voyage from London to Calcutta by the Cape of Good Hope in 1825 in 103 sailing days, is noteworthy. The distance is 11,450 nautical miles, and the vessel was under steam for 64 days and under sail for 39 days. The steamer afterwards (1829- 1830) made the trip between Bombay and Suez in 54 days, in furtherance of a schème to reach the former place from London by the Red Sea route. The year 1838 witnessed the successful transatlantic voyages of the steamers “ Sirius ” and “ Great Western.” The latter vessel, built under the advice of J. K. Brunel, the engineer of the Great Western Railway Company, was the first steamer actually constructed for the transatlantic service. She was built of wood, her dimensions being—length 212 ft., breadth 35½ ft., depth 23¼ ft. and tonnage 1340 B.O.M.; and her total displacement on a draught of 16 ft. 8 in. was 2300 tons. Although not originally built for the service, the “ Sirius ” was subsequently placed on it at the recommendation of Mr M'Gregor Laird of Birkenhead. This vessel also was built of wood, and was 178 ft. long, 25½ ft. broad, 18¼ ft. deep and her tonnage was 703. Mr Laird’s arguments in favour of placing the vessel on the transatlantic service throw light on the steaming capabilities of vessels of that day. He pointed to the steamers “ Dundee ” and “ Perth ” making 11 m. per hour, “ in all weathers, winter and summer, fair and foul and to the other vessels making from 10 to 10½ m. per hour. He based his estimate for the coal required on the voyage on a speed of 10 m. per hour and a coal consump­tion of 30 tons per day, which gave 525 tons for the whole voyage. Finally, he allowed 800 tons, corresponding to the difference of the displacement at 15 ft. load draught and at 11 ft. light draught, so that he had a margin of 275 tons for contingencies.

All the vessels just named were propelled by paddle-wheels. The screw propeller had been advocated as a means of propulsion by many inventors in England, France and America during the latter half of the 18th and the early part of the 19th century; a number of experiments had been made, but these had not been brought to a successful issue, as no suitable steam engine was available for driving the propeller. Benjamin Franklin, in 1775, drew attention to the inefficiency of side paddle wheels as a means of propulsion, and proposed as an alternative to set the steam engine to pump water in at the bow and force it out at the stern, the water passing along a trunk. In 1782 a boat 80 ft. long, fitted with this means of propulsion by James Rumsey, was driven at 4 m. an hour on the river Potomac, and a number of other vessels similarly fitted followed. In 1839 Dr Ruthven took out a patent for this method of propulsion in which the piston pump was replaced by a centrifugal pump; and in 1865 the “ Nautilus,” a vessel of this type, so impressed the British Admiralty of the day that an armoured gunboat—the “ Waterwitch ”—was provided with this system of propulsion. She was built of iron, 162 ft. long, 32 ft. broad, 13 ft. 9 in. deep, was double-ended and fitted with bow and stem rudders, but was otherwise similar to the armoured gunboat “ Viper ” built at the same time and fitted with a screw propeller. Many trials were carried out with the “ Waterwitch ” and “ Viper,” but the system adopted in the former was not repeated because of the great advances made in connexion with the screw propeller.

Many useful experiments appear to have been carried out by Colonel John Stevens in the United States in the early years of the 19th century, but, although some beautiful models of propellers made by him still remain, the system was not generally adopted until its commercial possibilities were more successfully demonstrated by Captain John Ericsson—formerly an officer in the Swedish army —and F. P. Smith of England. Smith took out his patent for the propulsion of ships by means of a screw fitted in a recess formed in the deadwood, in May 1836, and in July of the same year Ericsson, then practising as a civil engineer in London, took out his patent. Small vessels were built and fitted by both inventors and both were tested in the Thames. In 1838 Captain Robert F. Stockton, on behalf of the U.S. Navy, ordered two iron boats of Messrs Lairds of Birkenhead, to be supplied with steam engines and screw propellers of Ericsson’s design. The first boat was named the “ Robert F. Stockton,” and arrived at New York under sail early in 1839, with her machinery on board. The machinery was fitted in her at Bordentown, and under the name of “ New Jersey ” the boat afterwards served as a tow boat on the river Delaware. She was 70 ft. long, 10 ft. beam and 6 ft. 9 in. draught, and could steam about 10 m. an hour. Ericsson had the satisfaction of seeing his plans very largely adopted in the American Navy, but the mercantile marine adhered with great pertinacity to the paddle-wheel.

Fincham, writing in 1851, says that in England engineers were reluctant to admit the success of the screw propeller, and adds: “ A striking instance of prevailing disinclination to the screw propeller was shown on the issue of a new edition of the *Encyclopaedia Britannica,* in which the article on steam navigation contained no notice whatever of the subject.”

Smith, however, persevered, and with the assistance of some influential people of the day—notably Messrs Rennie & Co.— formed the *Ship Propeller Company,* and in 1838 built the “Archimedes,” a vessel of 237 tons burthen, to illustrate the value of the plan. The length of the vessel was r06 ft. 8 in., breadth 21 ft. 10 in., depth in hold 13 ft., draught of water 9 ft. 6 in., h.p. 80 nominal, but only 66 could be developed. A speed of about 7½ knots could usually be maintained, but on one run of 30 m. under very favourable circumstances a speed of 10·9 m. was reported. In 1840 she was placed at the disposal of the Admiralty for experiment, and the trials were favourably reported on. She afterwards passed into the hands of Brunel, who was so satisfied with the results of further trials that he modified the design of the “ Great Britain ” steamship then