horses power. Bell's success immediately excited com­petition : and a vessel called the Elisabeth, 58 feet in deck, and with an engine of 8 horse power, was started by Mr John Thomson on the 9th of March 1815. The spirit of enterprise was now roused, and steam-boats rapidly succeeded each other, every succeeding one ex­celling its predecessor in power and beauty. No longer timidly confining themselves to the navigation of rivers, the projectors of those steam-ships boldly steered into the deep waters, crossing the channel between Great Britain and Ireland, and performing the dangerous coast­ing voyages between Glasgow and Liverpool, Leith and Aberdeen, and Leith and London.

The first person who ventured beyond the precincts of a river was in all probability R. L. Stevens of Hoboken. This gentleman had been associated with Chancellor Li­vingstone, previously to the connexion of the latter w th Fulton and had brought his experiments to a successful issue nearly as soon as Fιιlton and Livingstone. Fulton having, however, secured to himself the exclusive privilege of navigating by steam in the state of New York, Ste­vens at once conceived the bold idea of taking his vessel by sea from the Hudson to the Delaware. To Mr Ste­vens many of the improvements of steam navigation are to be ascribed. He introduced the modifications of Watt's engine which we have represented in Fig 2, p. 693, still in use in American vessels. He introduced engines of long stroke ; and, as a necessary consequence, a long crank, and the further peculiarity of upright guides for the piston-rod, instead of the old parallel motion. To him we likewise owe the puddle-wheel with divided boards, by which the resistance of the water was rendered more uniform. and the concussions of the common paddle­wheels avoided. He improved the shape of the Ameri­can steam vessels, by substituting for the full round bo ws and sterns a fine entrance and a fine run. By this, and by making the length of his vessels eight or ten times their beam, he succeeded in raising their rate of sailing from nine to thirteen miles an hour.

Reverting to Britain, we find from the first intro­duction of Bell's Comet in 1813, steam navigation gra­dually improving as an art. The vessels were, however, of small dime· stone of low proportion of power, and of little speed, until the year 1818, when Mr David Napier directed his attention to the improvement of steam navi­gation. It is to this gentleman that Great Britain owes the introduction of deep sea communication by steam vessels, and the establishment of post-office steam- packe∣s. In 1818, Mr Napier established between Greenock and Belfast a regular steam communication, by means of the Rob Roy, a vessel built by Mr William Denny of Dunbarton, of about 90 tons burden, and 30 horse power. For two winters she plied with perfect regularity and success between these ports, and was after­wards transferred to the English Channel, to serve as a packet boat between Dover and Calais. Having thus ventured into the open sea, Mr Napier was not slow in extending his range. Soon after, Messrs Wood built for him the Talbot, of 120 tons. With two of Mr Napier's engines, each of thirty horse power, this vessel was in all respects the most perfect of her day, and was formed on a model which was long in being surpassed. She was the first vessel that plied between Holyhead and Dublin. About the same time he established the line of steam ships between the stations of Liverpool, Green­ock, and Glasgow. For the traffic of these stations he built the Robert Bruce, of 150 tons, with two engines of 30 horse power each ; the Superb, of 240 tone, with en­gines of 35 horse power each ; the Eclipse, of 240 tons, with two engines of 30 horse power each. All these were established as regular deep sea traders before the year 1822, on a station which has not since been surpassed for the power, beauty, and speed of its steam vessels.

In 1822 was built by Messrs Wood on the Clyde, the James Watt steam-vessel, to ply between Leith and London. This vessel was of 448 tons measurement, and she carried two engines of fifty horse power each, made by Messrs Watt and Bolton, and completed entirely under the superintendence of Mr Brown of that firm. The James Watt was remarkable for having its paddles moved, not directly by the engine, but through the inter­position of toothed wheels, so that the number of revolu­tions of the axis of the engine was greater than that of the paddles. With the exception of the low proportion of its power to its tonnage, the James Watt possesses almost all the qualities of the most improved vessels of the present day.

The next great advance in the art was made in 1826, when the first of the leviathan class of steamers, the United Kingdom, was constructed. This steam-ship was 160 feet long, 261/2 feet beam, and 200 horse power. She was built by Mr Steele of Greenock, and the engines were constructed by Mr Napier. Mr David Napier was also one of the first persons to introduce surface con­densation in marine engines. He used it successfully in the Post-Boy, a steam-vessel built by him. The con­denser was composed of a series of small copper tubes, through which the steam passed towards the air-pump; and, a constant current of cold water encircling the papes, the steam was cooled and returned into water, which was again sent into the boiler for conversion into steam, without being mixed with the cold salt water, which, in the usual plan, is injected into the condenser. But, like Watt, Cartwright, and others, wl∣o have tried this system both here and in America, he did not find the rapidity of condensation sufficiently great, and he returned to the old system of condensation by jet. Some years after­wards, however, he reverted to this system in peculiar circumstances which rendered it desirable ; and, using flat plates instead of tubes, was again perfectly successful, and plied tor years with no other condenser. But, like all the other cases where it has been introduced, the ad­vantages of the system were not reckoned equivalent compensation for its disadvantages. The plan of con­densation by tubes, again introduced at a recent date by Mr flail, has been tried in numerous vessels, in some of which it has been abandoned, and in others it still con­tinues to be employed.

The next change introduced very extensively into steam-vessels by Mr Napier, was the use of an upright or vertical steam-engine, or engine of direct connexion. The first engine of Bell was to some extent a vertical engine, inasmuch as the axis of the cylinder and of the crank were placed in one vertical line; but there was no direct connexion between the crank and the piston-rod to the paddle-axle, the communication of motion to it being effected through the medium of toothed wheels. In the common or lever engine the piston-rod acts on a cross-head, the cross-bead on side-rods, the side-rods on side-levers, the lever on a cross-tail, the cross-tail on the connecting rod, the connecting rod on the crank-pin, by which through the axle the paddle-wheels revolve. In the engine of direct communication, the side-levers, and some other parts of the train of communication, are removed by a device which enables the piston-rod to be almost immediately attached by a connecting-rod to the cranks of the paddle-shaft. This plan was first adopted by Mr Gutzmer of Leith, who built a vessel called the Athole, and another called the Tourist, on this prin­ciple ; but his method, though very simple, was not applicable in ordinary cases; and Mr Napier made se­