great success in his hot-houses. In a brief and hurried notice, it is impossible to do justice to so remarkable a man. In the words of a cotemporary writer: "His mechanical genius was of that order that it may, without exaggeration, be asserted that if Watt had not previously invented the steam engine, he was capable of achieving it. Others before him had prepared the way; others since have contributed valuable improvements in detail; but to George Stephenson unquestionably belongs the proud title of the Author of the Railway System. He gathered the many threads of ingenuity and enterprise, and weaved them into the wide-spreading net-work which promises, in its manifold extension, to envelope the whole world in bonds of commerce, civilization, and peace." Ibid.

On the Improvements which have been made in Steam Navigation.

Read before the British Association for the Advancement of Science.

By MR. SCOTT RUSSELL.

The first great improvement that had been made was in the boilers. Formerly, the boiler flues were constructed of great length, so that the smoke was kept winding round and round in the flues, and at last was allowed to escape with difficulty. Now, however, they had adopted the plan of getting as much fire as possible, in the shortest space of time,—and this had been accomplished by imitating, as nearly as they could, the locomotive engine boiler, by having tubes of thin metal, which would evaporate a much greater quantity of water in the same time as flues of the usual thickness; now, also, instead of taking the smoke a long dance, as in the old fashion, they used short flues of four to six feet in length, and by having a great many of as thin metal as possible, they heated the greatest quantity of water, and had the additional advantage of keeping the metal cool,—in consequence of which a boiler of smaller extent and surface was of much greater efficiency, with less weight of metal. The next point of improvement was in the engine, in the construction of which, however, there had been less change than in other matters. The former beam engine had been changed for the direct action engine, which was of various kinds; but the greatest change which had been made within the last ten years, consisted in the employment of greater quantities of wrought iron in the construction of the engines, instead of the mass of cast iron formerly used. This was the only great change,—for the newest Halifax steamers were still fitted up with the old-fashioned or lever engines. The next improvement consisted in working steam expansively to a much greater extent than heretofore. It was only within the last ten years that they had adopted this principle: the effect of which was, that, instead of completely filling the cylinder with steam, they filled only to the extent of one-fourth—a volume of steam not of course of equal density, but by which they got two-thirds of the work done, and at one fourth of the cost. The next improvement had been made in the paddle; not so much, perhaps, in the wheel itself—for he was still inclined in favor of the old paddle-wheel, although, for short voyages,

he admitted the advantage of the feathering paddle-wheel, which had been advocated by Mr. Price at their meeting some years ago, and he had then opposed him—but of this by-and-bye. Another great improvement which had been made, was the driving the paddle-wheels faster. They had an old maxim, which was, whereas a good old horse, going $2\frac{1}{2}$ miles an hour, could not draw advantageously at more than 220 feet per minute, and that, as the steam engine was only a substitute for horses, and reckoned as so much horse power, it ought not to go faster than $2\frac{1}{2}$ miles per hour—and this one thing had kept them back for half a century. He did not mean that the result should be faster than $2\frac{1}{2}$ miles per hour, but that the piston should not rise up and down in the cylinder faster than $2\frac{1}{2}$ miles an hour, which was only 4 feet in a second, while the motion of steam of 15 lbs. was 1100 feet in a second. Fortunately, however, this old maxim had been abandoned, and the piston now moved from 250, 270, to 300 feet in a minute. For this improvement they were indebted to no new principle, but to the application of mathematical principles of science. He now came to another great improvement, which was the change in the formation of steamboats, which had been radical—he meant the entire alteration in the form of the ships. A few years ago, steam vessels which would go ten or twelve miles an hour were deemed fast ships; now, however, we had attained a much higher rate of speed. Vessels were then built on the old-fashioned principle that the water-line should be nearly straight, and that the run of the vessel should be a fine line, and that there should never be a hollow line, except a little in the run of the ship, but that there most certainly should not be any hollow line in the bow, for there the water-lines should be straight or a little convex. Researches and inquiries were, however, made by a Committee of the British Association, as to the form which would enable the vessel to go fastest through the water. These inquiries lasted for years, and they established, by a series of experiments, a set of very curious facts. Formerly, every builder of ships had his notion of proportion; some that the length should be four times the breadth,—others that it should be $4\frac{1}{2}$ or 5,—and some went as far as to say that the length should be six times the breadth, but these were deemed innovations: so that, although the proportions of width, as compared with breadth, were said to be fixed ones, yet strangely enough, every one differed as to those proportions. Another question was, what part of the vessel should have the greatest width, and it was generally thought that the greatest width should be nearest the bow. Some daring persons had, however, put it back as far as the centre of the ship. This was, however, the exception, and not the rule. Then there was another great principle, which was, that the bow and the stern should exactly balance each other,—that is, that the vessel should be equally balanced; but the new rules which the British Association had established were as follows:—They began by upsetting the old rule with respect to the proportions which the length should bear to the breadth, finding that the greater the speed required, the greater should be the length, and that the vessel should be built merely of the breadth necessary to enable the engines to be put in, and to stow the

requisite cargo. Then the second great improvement made by them was, that the greatest width of water-line, instead of being before the middle, should be abaft the middle of the vessel, and, in fact, two-fifths from the stern, and three-fifths from the bow. The next great improvement was that, instead of having the bow broad and bluff, or a cod's head bow, for the purpose of rising over the wave, you might have hollow water-lines, or what were called wave lines, from their particular form, and with that form the vessel would be propelled with less power and greater velocity,—and also, that instead of keeping to the old fine run abaft, and cutting it away, you might, with great advantage, have a fuller line abaft, provided it was fine under the water. Thus, by these improvements, the form of the old vessel was pretty nearly reversed, to the great annoyance of the old school, and the steamers were given large and commodious cabins and after holds, instead of having cabins so pinched in that you could hardly stand in them. Another heresy, introduced by the British Association, was that of the principle as to the balance of the stern and the bow upon which they now rested; but which was founded in a most singular error, for they left out something which was very material. They concluded that the wave acted equally on both ends of the vessel in striking it; but they did not take into consideration the impossibility of this when a vessel was moving, not having taken into calculation the velocity of the wave, or of the vessel, and that from this circumstance, the concussion from a wave striking the bow would be a most powerful one, while it could not be so with regard to the stern, because if the velocity of the wave meeting it was fifteen miles, the shock would be as of thirty miles; and, therefore, it became most plain that the bow would give the greatest resistance to the wave. He had examined all the fastest steamers which had accomplished fifteen to seventeen miles an hour—and in smooth water eighteen miles an hour; and he would venture to state that there was not one of them, which accomplished from fifteen to seventeen miles an hour, which had not all these alterations in every particular, and that the wave form and wave principle were now adopted by all the great steamship builders, and that all the fast steamboats had what was called the wave bow. Now, of the eight boats on the Holyhead and Dublin stations, if examined, it would be found that all of them were built on these principles, although in some of them there was still left a little of the old principle, some of the boats being made a little fuller and more straight; and if any one would look at one of these boats, it would be perceived that the moment they moved, the very wave itself rebelled against them, and broke against their bows,—and that consequently these were slower than any of the others. All of them, however, were vessels of the first class; and he gave the details of their construction,—for which we have not space. All of them were examples of the value of the form, and the principles which the British Association had advocated and introduced at a very early period in its history.

Mr. J. Taylor stated that as Treasurer of the Association, he could bear witness to the value of the efforts of the Association in this direction; and he felt bound in justice to state, that the credit Mr. Russell

had given to the Association, was chiefly due to himself, as the individual who, with the late Sir J. Robinson, had conducted the investigations on this subject.

Mr. J. Price rose to say that he agreed with Mr. Russell in all that he had adduced. There was, however, one mode of steam navigation—one mode of propulsion to which he had not alluded, he meant the mode of propulsion by the screw propeller. He would, therefore, mention that they had built a little vessel, called the Neath Abbey, which plied from Neath to Bristol, a distance of upwards of sixty miles, and which had only two 12-inch cylinders, in fact a mere toy—of course using high steam. Now, she could walk round the Beresford, which had two 40 horse power engines:—the working her upon the high pressure steam principle necessarily increased the speed of the piston. With these engines they had stepped out of the old track. They had not adopted the American plan of a high pressure engine, and puffing off the steam, but of a high pressure engine without puffing off the steam, and without using a jet of cold water. He confessed that, when this plan was proposed by his younger coadjutors, he, as one of the old-fashioned, hesitated,—but at length he consented. The Neath Abbey had a screw propeller with three blades, which were immersed under the water—her propeller being about 3½ feet in diameter. The vessel is built in the best form, allowing sufficient breadth for her engines. The two 12-inch cylinders are placed diagonally, and slung up by wrought iron beams, and they lay hold of one crank pin, like the hands of two men working at a grindstone; and thus they conducted their engines almost in a snuff-box. They then employed their boiler in the manner described by Mr. Russell. Then they came to the condensation of the steam, which they did not allow to go puffing off, but let it pass back into the boiler, condensed and in a distilled state,—which accounted for their never having any mud or dirt in their boilers.

Ibid.

AMERICAN PATENTS.

List of American Patents which issued in the month of August, 1847, with Exemplifications, by CHARLES M. KELLER, late Chief Examiner of Patents in the U. S. Patent Office.

1. For an *Improvement in Hydraulic Engines*; James McLaughlin, Philadelphia, Pennsylvania, August 7.

The patentee says,—“My improvement consists in securing to the bottom of the valve a cross-head, having an anti-friction wheel or pulley on each extremity, which run on the under side of the bottom plate of the cylinder, for the purpose of counteracting the upward pressure of the water from the column, against the lower surface of the valve, and holding said valve firmly on its seat during the operation of the engine.”