first vessel of this form was an experimental one of 75 feet keel, laid down in 1834. The next was a steam-vessel of 100 feet keel, constructed in 1835. The next were two pleasure yachts of Mr Ashton Smith, a wealthy proprietor in Wales, whose observation on vessels had independently led him to the conclusion that hollow lines and a peculiar midship section gave the easiest and best sea steamers ; and both of these vessels, of 1838-39, though merely approximations to the true wave-lines, were remarkable for their speed and other excellent qualities. The fourth vessel of this class was the Shan­don steam-vessel, altered from the old to the new lines, 1840, with a gain from the same engine of from two to three miles an hour in speed. This vessel is the pro­perty of Mr Robert Napier. The next and last vessel is the Flambeau, built in 1840, on the wave principle, by Mr Duncan of Greenock, with the co-operation of the present writer. This vessel, with the smallest proportion of power to tonnage, and with the smallest supply of steam, is, nevertheless, by far the swiftest vessel on the Clyde. The Fire-king, the largest of this new class of vessels, is 660 tons, and has engines of 220 horse power. The Flambeau has only 70 horse power to 280 tons measurement. Vessels of this class have been found at sea to be both easy, stiff, dry, and lively ; while they are by far the fastest vessels of their power. The speed of the Fire-king, now the property of Mr Robert Napier, is fifteen miles an hour in still water. The speed of the smaller vessel, the Flambeau, with very deficient steam, is fourteen miles an hour ; a velocity which, with her small proportion of steam-power, is only to be attributed to her superior form, and the slight de­gree of resistance which she encounters from the water.

The principle on which these wave-ships are con­structed is, that the hollow lines forming the entrance are to correspond, as nearly as may be consistent with the form of a ship, to the form of a certain wave ca­pable of moving with the same velocity as the vessel. The analogy between the displacement of the water by a wave of the first order, and its displacement by a ves­sel moving with the same velocity, being so very close as to approach to identity, rendered it probable that the same mode of displacement would be followed in both cases with the same result, viz. the production of minimum resistance. It was further to be anticipated, that as a wave, when allowed to follow the usual mode of dis­placing the particles of water over which it passes, pre­sents a smooth and unbroken swelling surface, so the ves­sel, if of the proper shape, according to these wave-lines, would divide the water at the bow in a smooth, unbroken sheet, instead of showing the usual head of water or surge exhibited at the bow of ordinary vessels at high velocities. On the other band, when a wave encounters a shapeless rock, or breaks on a rugged coast, it exhibits the same violent surges which are presented on the bow of vessels of the usual form. Thus, then, the analogy leads us to suppose, that the smooth, conti­nuous, resisting displacement of a wave, would be the best method of displacement for a vessel. On submit­ting the question of least resistance to the elementary calculation, it appeared that the form of least resistance was very close indeed to that of the wave. The science of hydrodynamics is not, however, sufficiently matured to enable us to place implicit dependence on all the re­sults of its calculations, unless where they are supported by actual observation ; and it therefore became necessary to make the experiment.

For the purpose of determining whether this form were that of least resistance, an experimental vessel, about seventy-five feet long, was constructed on a hypotheti­cal form of least resistance, with the wave water lilies. When this vessel was propelled at the rate of seven­teen miles an hour through the water, it was found, that instead of the usual surge exhibited at the bow of other vessels, the water was parted so smoothly and quietly, that no white spray nor other symptoms of high speed and great resistance were visible, and the parted water returned peaceably to the place it had occupied previous to the transit of the boat, with only a slight translation forwards. It appeared, therefore, from the experiment, that no greater quantity of motion was com­municated to the water than was necessary to permit the vessel to pass through, and with no greater velocity than the speed of the vessel demanded. It was then presumed that this form was that of least resistance; and all subse­quent experiment appears to demonstrate the truth of this inference from fact, as predicted by analogy and cal­culation.

It is also worthy of remark, that this form is capable of being combined with all the good qualities of a steam­ship, such as strength, dryness, easiness, as well as great speed ; but as the construction of such vessels may still be deemed an experiment in progress, the writer will not occupy more space with observations on his own researches. Thus much he felt it his duty to communi­cate, in order to adapt this article to the most recent condition of steam-navigation.

*The immediate Mechanism of Propulsion.—* The paddle-wheel of the ordinary form (as given in the plates) seems to be the most perfect, as it is the most simple means of propelling vessels through the water. The idea soon occurred, that as the steam-engine is cal­culated to turn round wheels, it is only necessary to place, on a wheel on the outside of a boat, large teeth or paddle-boards to take hold of the water, and so drive the vessel forward by simply turning the wheel. It was this plan that was adopted by Jonathan Hulls, in the first plan of a steam-vessel. But there is no piece of mechanism (if we except, perhaps, the crank of the steam-engine,) which has been more despised, or which more strenuous and frequent attempts have been made to improve or supersede, than the common paddle-wheel. It is remarkable, that like the crank steam-engine, the paddle-wheel is almost uni­versally employed in practice, after the fullest experi­ment of many diversified improvements. In fact, after experiments of all sorts of oars, propellers, paddles, chaplets, screws, &c., the common paddle-wheel conti­nues to predominate as “ *the* propeller.”

The mimerons faults attributed to the common paddle­wheel, are chiefly faults of misconception or malconstruc­tion. It is easy to account for both.

When a steam-vessel is at rest in a harbour, and pre­vented from moving, or when in the act of setting out into motion after having been at rest, the defects of the common paddle-wheel appear to be very great. The pad­dle-boards, fig. 32. on entering the water, press obliquely down into it, tending to raise or lift the vessel up out of the water with a force which pro­duces no useful effect. Again, when the paddle is rising out of the water behind, it seems to do little more than raise or drive the water upwards in the form of back water. It is only, therefore, in the middle of its path that the propul­sion of the paddle seems ex­erted in forwarding the boat, and that only for a very short time. A large part of the force of the steam-engine seems thus to be expended in raising up the vessel, and