geometrical problem in a mechanical apparatus, this paddle-wheel would have great efficacy even when very deeply immersed. It is, however, difficult to make this motion perfect at Μ. But this species of mechanism has been very beautifully combined and arranged by Morgan, Seaward, Cave, and others, whose geometrical apparatus is very beautiful. Unhappily the apparatus, even in its most perfect state, is only correct for a single velocity of vessel and of wheel : for a different velocity, the point of radiation of the paddles must be changed, or loss is at once incurred. Hence it is found that this apparatus, like the common paddle, is liable to imperfec­tions of action, with every change of immersion and ve­locity. When to this there are added the complexity, friction, cost, wear and tear, liability to accident, of this moving mechanism, introduced for obtaining the partial remedy or slight amelioration of an evil which by proper arrangement is but slightly felt under the old method, it becomes manifest, that the general abandonment of the radiating paddle-wheel, and the return to the common one, has not been without sound practical reason.

The last species of paddle-wheel is that with the fixed float : in other words, the simple paddle-wheel with boards placed around its rim. Of this there are various modifications. A very simple modification is that men­tioned by Mr David Stevenson, in his excellent work on the civil engineering of America. The paddle-board of the usual wheel is, as it were, cut in two, one-half being placed half an interval in advance of the other, as in figs.

37 and 38. This may be called the divided paddle-wheel. The concussion of a paddle-wheel striking the water is much lessened by this means, and the propelling force is rendered more nearly uniform. Another form of this wheel may be named the split paddle-wheel, from having the paddle-board, as it were, split into two or more hori­zontal slips, by which the same advantage is obtained as from the divided paddle-wheel. It has been proposed to place these stripes in a cycloid ; but no advantage results from the arrangement, although the dignified name of the cycloidal paddle-wheel has been applied to it. Again, it has been proposed to place the paddle-boards at all sorts of angles with the axis of the wheel, both horizontally and vertically, but as yet without advantage.

A very simple expedient tends to remove all con­siderable irregularity or concussion from the common paddle-wheel. It is to allow the extremity of the paddle-board nearest the side of the boat, to descend from six to twelve inches deeper in the water than the outer extremity. This plan was carried into effect by the writer on a steam-vessel in 1836. The desired object was at­

tained without any sacrifice of power or speed. For dis­tinction we may call this the conical paddle-wheel. It is shown in figs. 40, 41.

In the three following figures we have represented the single oblique paddle-wheel. Fig. 44 shows the de­velopment or stretch-out of a part of the circumfer­ence of the wheel, to exhibit more clearly the arrange­ment of he paddle-boards.

In figs. 45, 46, the double oblique paddle-wheel is re­presented ; and in figure 47 the development of a portion of its circumference is given.

*The Reefing Paddle.—* One of the greatest improvemens on paddle-wheels, and one of especial import­ance to steam navigation, still remains to bo innvented