tinual evaporation of the water, at the rate of 6 gallons for each horse power every hour.

The differences between the arrangements of the ma­rine steam-engine used in Great Britain and the land steam-engine, are chiefly these : the lever or great beam, which, in the land-engine, is above the top of the engine, and which in large engines is generally composed of a pair of thin deep beams of cast-iron, united side by side into one ; this single beam is brought down in the marine engine to the bottom of the engine, or rather one-half of the great beam is placed on either side of the cylinder, the two being connected together from the op­posite sides of the engine, so as to act simultaneously as a single lever. This form of engine, sometimes applied to other purposes as well as to navigation, is called, from this disposition of the working beam, the side lever engine.

Another peculiarity in the marine engine, sometimes however adopted in land-engines, is the place and ar­rangement of the condenser C, which, instead of being placed in a cistern of water, is set immediately on the centre of the engine, the condensation being wholly effected by the play of the jet of water in the interior of the condenser, without surrounding its external surface with cold water, as in the stationary engine. When thus placed, the condenser has also the advantage of giving support to the main centre of the engine, around which the levers move in giving revolution to the paddle-wheels.

Before proceeding further with this article, the reader is requested to make himself familiar with the parts and arrangements of the engine already described, by refer­ring to the plates of the marine-engines given at the end, and to the descriptions of them.

It will be observed that the air-pump *A* is generally placed on the side of the engine furthest from the cylin­der. This arrangement is convenient in point of room, and keeps the moving parts of the engine itself more perfectly in equilibrio.

Beside the air-pump is generally placed the feed-pump, designed to force water out of the air-pump or dis­charge-pipe into the boiler. This is the general dis­position of parts, which the reader will easily be able to recognise in the plates given with this article.

Although the lever-engine is the form most commonly employed for marine purposes, it is by no means the only form. Very many attempts have been made to obtain engines more compact and of less weight and bulk than the lever-engine. These are distinguished from the lever-engines by the names vertical engines, steeple-engines, and engines of direct connexion. It is still doubtful whether any of them, except in very pecu­liar circumstances, are practically to be preferred to the lever-engine ; on the contrary, objections of a serious nature are alleged against them.

We have already seen that the first steam-boat, the Comet of Mr Bell, had a vertical engine. It was re­marked of this vessel that the strain of the engine on the vessel was very small ; but this has been attributed to the low proportion of power to the tonnage of the vessel.

The first steam-vessel whose engines we had the pleasure of seeing, had a pair of vertical engines, made by Gutzmer of Leith; the paddle- shaft B being directly over the axis of the cylinders A, as in figs. *4.* and 5.

Modifications of this plan of direct or imme­diate connexion have been recently tried on a larger scale ; but the method has the disadvantages of admit­ting only a short stroke and a short connecting rod, and requires that the height of the axis above the bottom of the cylinder should be at least three times the length of the stroke. Thus, one of the extremes, too short a connecting rod, too short a stroke, or a paddle-axis too high above the floor of the vessel, is incurred.

To obtain the same object without incurring those evils, many descriptions of engine have been contrived. The following admits of placing the paddle axis at little more than double the height of the stroke of the en­gine. and gives a connecting rod of 11/2 or 2 times the stroke. The piston-rod P is inserted into a cross-head *d d,* to the extremities of which two vertical rods *d e, d e,* are attached. With the lower extremities of these rods the side-rods *g f, g f* are connected; the upper ends of these side-rods are attached to the cross-head *g g,* to the centre of which the crank-rod is attached.

This species of engine has the great disadvantages of **a** multiplicity of shafts, bearings, and cranks. I**t was** afterwards simplified by Mr David Napier in the manner represented in the following figures; viz. by uniting into one forked cross-head each cross-head with its side-rods.

Even thus, however, limits are placed on the length of stroke and height of shaft, so as to give rise to incon­venience in many circumstances. To remedy these evils, Mr Napier appears to have invented the follow­ing class of engines, to which the cant term of steeple­engines appears to be sufficiently appropriate. In the steeple-engine the piston-rod is made forked or divari­cated, so as, passing round the shaft, to rise above it to a considerable height, from which again descends the con­necting rod to the crank. The following example is that