*Robertson's Patent Chain Propeller.** By PETER SPENCE.

[Read before the British Association, 1859.]

At the request of the patentee and several gentlemen engaged in bringing this invention into practical operation, I have undertaken to give a short description of it to the Mechanical Section of the British Association.

It is well known that great efforts have been made to adapt steam power to the conveyance of both passengers and goods on canals, but although the failure of most of these efforts is apparent, from the fact that on a very few canals is it at this moment employed, yet there seems no reason to doubt that if steam power can be made to suit itself to the peculiarities of canal navigation, it will be found, as in every other department of mechanics, the cheapest and most convenient agent.

In 1831, when the first efforts seem to have been made to employ steam power on canals, Mr. Fairbairn, who was then engaged in an extensive series of experiments by which much valuable data was elicited, recommended for this purpose a peculiar form of steamboat with paddles in the stern; but however well these boats might otherwise have fulfilled the design, the surge from every form of paddle steamboat was no doubt the fatal barrier to their adoption. When at a later period the screw was adopted as a propeller, this seemed to meet the difficulties of the case, and screw propelled boats have to some extent been adopted and are now in use: but even the screw has been found only applicable to the few canals which are of considerable depth; and in these the danger always exists of a disturbance producing a disintegrating effect on the sides and bottom of the canal, and where, as in the majority of canals, the depth does not exceed 3 to 4 feet, the working of the screw is found to be altogether impracticable.

The invention of Mr. Robertson fully meets and obviates these difficulties arising from the use of both the paddle and the screw, while it possesses advantages in obtaining the full effect of the power applied, which are apparent at once. In whatever mode power is applied to the propulsion of vessels in water, by the paddle or screw, there is a great loss of power, only a part being productive, and the remainder wasted. For example, when the paddle is just entering the water on the one side, and leaving or emerging from it on the other, the powers expended in these actions only neutralize each other, and contribute nothing to the propelling of the vessel. So great is the loss of power in some circumstances, that one authority gives the following example:—Suppose a boat propelled in a stream, the power being affixed or applied to a cylinder on which a rope is wound, the other end of the rope being attached to a fixed point at some distance up the stream or on shore; and that the power is afterwards applied by paddles in the stream: it will, he says, take three times the motive power in the latter case than it does in the former to propel the vessel at the same speed. This, I think, must be an exaggerated estimate; but it clearly proves the great loss of power in certain cases, and the probability that it is considerable in all.

* From the Civ. Eng. and Arch. Jour., Dec., 1859.

The peculiar principle of Mr. Robertson's invention is, that he applies the power by dragging the vessel from a fixed point, and its great ingenuity is, that the fixed point is at the same time a moveable one,—a constantly fixed point in relation to the power exerted in propelling the vessel, and a constantly changing point in relation to the course on which the vessel is being propelled. The construction of the propelling apparatus is as follows:—At or near the bows of a boat, say 70 feet long, is placed a steam engine, the main shaft of which crosses the bows of the vessel at or about the level of the deck; a fixed pulley is attached to each end of this shaft, these pulleys projecting over the sides of the vessel; they are 3 feet or more in diameter, and on their periphery have a hollow or groove to receive the chains which are to run over them; they are also so constructed as to take firm hold of the chains as the power is exerted in dragging them over the pulleys. On the other or the stern end of the boat are two pulleys, also projected over, one on each side; these are loose, so that the chains merely run over them. Friction rollers are also placed along each side of the vessel, to carry the chains as they pass from the stern to the bows of the vessel; the chains, which are endless, pass or are dragged over fixed pulleys at the bow of the vessel, and falling down lie along the bottom of the canal, and thus become the fixed point or lineal anchor on which the power acts; the action of the engine in dragging the chain over the loose and fixed pulleys being necessarily to drag or propel the boat forward. Every yard of the chain passed over the pulleys representing a yard of space that the boat has progressed in her course—the fixed point or length of chain lying at the bottom of the canal still remaining the same, what is taken up at the stern being replaced by exactly the same length deposited at the bow. The speed of the vessel is thus exactly equivalent to the speed and size of the driving pulleys, unless, indeed, there should be any slip of the chain in passing over them, and this in practice is easily prevented, and is again exactly measured by the velocity of the chain, unless there should be a slip of the chain along the whole length over the bottom of the canal, and this, of course, is a mere matter of the weight of the chain. In repeated trials which have been made before thousands of spectators (and in more than one of which the writer was on board), in a boat 70 feet long and 7 feet wide, the chain used was only 20 lbs. per yard, or 40 lbs. per yard for the two chains, 22 yards of double chain being always at the bottom; this gives a weight or resistance of 880 lbs. in this case as the fixed point. From the data ascertained by Mr. Fairbairn, that in tugging vessels the average pull of a horse was 94 lbs., the fixed point in these trials would exceed nine horses' power, and an engine power of nine horses could therefore be exerted without the chain slipping over the bottom of the canal. The speed attained ranged from 4 to 6 miles per hour, and nothing more was attempted at that time; the motion was easy and regular, the facility for starting equal to either screw or paddle, and the power of stopping quite peculiar. The moment the engine stops she drags at anchor, and the momentum is absorbed before the vessel has proceeded one-half of her own length.

The weight of the chain can be doubled or quadrupled without inconvenience, and the capability of using increased power to any extent be afforded as required. The weight of chain when increased does not materially increase the loss of power, as the power expended in raising the chains at the stern is neutralized by the weight of the falling chain at the bows, the only loss of power being the friction on the pulleys and friction rollers as the chains pass from stern to stem of the boat above water, and that must be so trifling as not to merit calculation. The invention is not limited in its application to canals, but is suited to rivers where occasional shallowness may render either paddles or screw useless, or where a strong current would prevent any amount of power being got except at an enormously increased and therefore impracticable speed. No additional speed, but only an additional power, would be required by the chain propeller to stem the strongest current; and however shallow, if the boat will float the propeller will work.

It is almost needless to add that the working of the chain gives rise to none of that commotion in the water that constantly attends the working of both paddles and screw; the chains rise and fall without the least perceptible agitation of the water, and even the ordinary wave from the bow of the boat is cut in pieces by the falling chain and reduced to the merest ripple.

Proceedings of the British Association for the advancement of Science.

29th Annual Meeting, Sept., 1859. (Continued from page 117.)

SECTION G.—*Mechanical Science.**

Monday, 19th.—"On a New Gas-Burner, and a Method of producing an Illuminating Gas cheaply from the Decomposition of Water," by the Abbé MOIGNO.

"On an Automatic Injector for feeding Boilers," by Mr. GIFFARD.

"On a Helico-Metre, an Instrument for Measuring the Thrust of the Screw-Propeller," by the Abbé MOIGNO.

"On an Application of the Moving Power arising from Tides to Manufacturing, Agricultural, and other Purposes, and especially adapted to obviate the Thames Nuisance," by Dr. SEGUIN.

"Description of the Granite Quarries of Aberdeen and Kincardineshire," by Mr. A. GIBB.—The working of the quarries in Aberdeen commenced 250 years ago; but little progress was made for 100 years. The houses in Aberdeen were constructed principally of wood till 1741, when a fire taking place, the town-council ordained that the fronts of the houses should be built of stone or brick. In 1764 granite was recommended for paving the streets of London, and was used for Waterloo Bridge in 1817, and subsequently for the docks at Sheerness and London Bridge. There are upwards of twenty quarries supplying the different varieties of granite: the blue, the red or Peterhead granite, the light red, soft grey, and white. The granite, for the most part, lies in irregular masses in the quarries, and generally of columnar structure. The quarrying is principally carried on by blasting. The

* From the Lond. Athenæum, Oct., 1859.