THE FIRST SWEDISH STEAMBOAT.

In 1804, an English engineer, Samuel Owen by name, was sent to Sweden by his employers, Messrs. Fenton and Murray, of Leeds, to erect a steam engine for a person called Edelcrantz, and was employed in various engineering undertakings throughout Sweden until the year 1809, when he established himself as an engineer and ironfounder at Kungsholmen, an island forming part of Stockholm, where he worked more than thirty years producing steamers and steam engines. He was the first to introduce the former into Sweden. His first attempt was made in 1816, by placing on board a craft, which he called the Witch, an 8-horse condensing engine which drove a propeller with four blades.

Our engraving on page 259, which we reproduce from the columns of the *Engineer*, is a copy from Owen's original drawing. With this arrangement the Witch had a speed of four and a-half knots an hour, which was even in those days considered to be too slow. In 1818 this engine was taken out of the Witch and put on board of a steamer called the "Amphitrite." It was connected through gearing with side wheels, and a speed of between five and six knots was obtained. This was the first passenger boat in Sweden. From this it will be seen that Owen was the father, so to speak, of steamers in Sweden, and is acknowledged as such by the Swedes in general who are now erecting a monument to his honour in Stockholm; this monument is to be unveiled on the 12th of May next, the 100th anniversary of Owen's birth, and a scholarship will also be created at the engineering college, which will be called the Samuel Owen's Scholarship. He died in Stockholm in 1854.

SINGLE RAIL RAILWAYS.

Haddan's Pioneer or Single Rail Caravan.

The present system of railway construction is just now the object of many attempts at alteration, or rather of adaptation to the requirements of the different localities in which attempts are being made to extend the great pioneer and improver of civilization. We have already referred to the very narrow gauge roads which have been so successfully carried out in Wales, and more recently we described a locomotive constructed in the United States for use on a single elevated rail. Our illustration on page 262 is of a new cheap railway, the invention of Mr. J. L. Haddan, C. E., engineer in chief to the Imperial Ottoman Government. It is from the columns of *The Engineer*, to which journal we are indebted for the following description of this curious invention.

"Many attempts, (says Mr. Haddan) have been made with the view of substituting one rail for two in the construction of railways and tramways, though hitherto with but indifferent success; for as a rule we find that three rails or running surfaces of different materials have simply been substituted for the usual pair of iron rails.

"The practical experiments hitherto made in this direction have been principally confined to existing roads, where the central rail is supposed to carry the greater part of the weight, the equilibrium being maintained by huge side wheels running on the road itself. In France and Portugal considerable success has attended this system, though theoretically it is far from being perfect, especially for a constantly changing load, such as passengers; moreover, it is open to the objection of requiring a first-rate road."

Mr. Haddan then states that it has been his endeavour for some years past to provide an economical railway suitable for a country like Turkey, where all the conditions are very unfavourable to railway construction proper, and so very different in every respect from England. "Money at 20 per cent., traffic inconsiderable, country very rough, all materials and skilled labour to be imported, no notion of the value of time, water scarce, enterprise unknown, labour far from plentiful, fuel dear, soil for the most part rocky or marshy, distances enormous, transport often impossible, produce generally agricultural—and therefore bulky—difficult and costly of transport, no cross-roads, few, if any, important manufacturing centres; the only feasible outlets are the river-beds, for the most part far too steep for railway use, and whose valleys moreover are generally far too narrow and precipitous to admit of making detours for so moderating the inclines as to render them practicable for railways. In Asia Minor it has been found impossible to penetrate the country, except with miles upon miles of gradients of 1 in 30, and only then by means of the sharpest of curves, frequent tunnels and viaducts, and the heaviest of earthworks."

Mr. Haddan, after some remarks on the working of ordinary lines, goes on: "To obtain perfect economy in the construction of a railway, all the parts of a train should weigh the same per metre run, else we shall find our rails and bridges too strong for the weight of the carriages, or not strong enough to support the ponderous engine. Seeing that the disparity of weight between our carriages and engines is as much as 4 to 1, it shows us that by simply reducing the weight of the engine to that of the carriages we should obtain off the reel an economy of 75 per cent. in the first cost of rails and girders, and in addition no mean saving of wear and tear. Next, the moment we leave the level and attempt inclines our engine has to be made still heavier, and mighty brakes—worse than useless in ascending—have to be made use of for the descents; whereas, in fact, the steeper the inclines the more we ought to lighten our burdens, but, unfortunately, the very reverse is the case in practice.

"All such objections (says Mr. Haddan) have been carefully met in designing the Pioneer, which the author considers peculiarly suitable for Turkey, the colonies, and even the mountainous portions of our own country. The Pioneer or steam caravan, has its origin in a wooden post and rail railway erected some thirty years since at Posen. It worked for many years drawn by horses, and later on by a stationary engine, but locomotive steam traction could not be made use of owing to the fact that weight was in those days necessary for obtaining power in the locomotive—a burden which the wooden fence could not stand. Many engineers have since attempted to overcome this difficulty, but it seems to me that the Fell horizontal grip, where unlimited adhesive power can be obtained quite irrespective of the weight of the engine, is the only practical means of overcoming the difficulty. The permanent way of the Pioneer consists of a wall of a minimum height of 2ft. 3in. and 14in. thick, surmounted by a single rail and sleeper, which simply consists of a 1½in. plank laid on edge in cement and tipped with thin half round iron strips. The wall rarely exceeds 2ft. 3in. in height, because the gripping powers of the locomotive allow the gradients to be traced nearly coincident with the natural surface of the ground, that is to say, with its grosser features. Of course little dips are not gone into, and ravines are made light of and spanned by sandwich arches in masonry, or with a single iron girder of but a few inches in width. The locomotive and rolling stock are, so to speak, "twin," and mount astride the wall like a man on horseback, or rather like the panniers on a donkey. The carriages are thus double, one-half on either side of the wall, the roof being common to both; there is a space of about 18in. in width between the two halves, forming as it were a passage between them, in the upper part of which are situated the single wheels which are to run on the summit of the wall; the lower part of the passage is open from end to end to allow the carriage, when hung on the wall, to hang down to a depth of 2ft. 3in. on either side. The locomotive is purposely extended as much as possible and is articulated, water in one section, fuel in another, boilers in another; by which means its weight per metre does not exceed that of the carriages or wagons when laden. The weight per metre run is about 8 cwt. The total length is 24ft. 8 metres, and its power is sufficient to take 100 passengers up an incline of 1 in 10 at a speed of fifteen miles an hour. The great economy manifested in the construction of the Pioneer permanent way is owing to nine major points and divers less important ones:—(1) The load is spread out over as great a length as possible, and concentration of weight is carefully eschewed. (2) The load or weight of the train is evenly distributed throughout. (3) No banks or cuttings are required, owing to the special powers of the locomotive enabling the train to follow the natural surface of the soil. (4) No transverse levelling of the soil is required, because the train does not run on the ground, but on the top of the wall. (5) The size of the rolling stock is reduced to the minimum, sufficiently large to accommodate passengers almost singly, and goods piecemeal, whereby the size and cost of tunnels and under-bridges are reduced to a mere trifle. (6) The light weight of the Pioneer permits rapid travelling even over the roughest ground. (7) The time of construction may be measured by months instead of years, an important economical item, where interest on