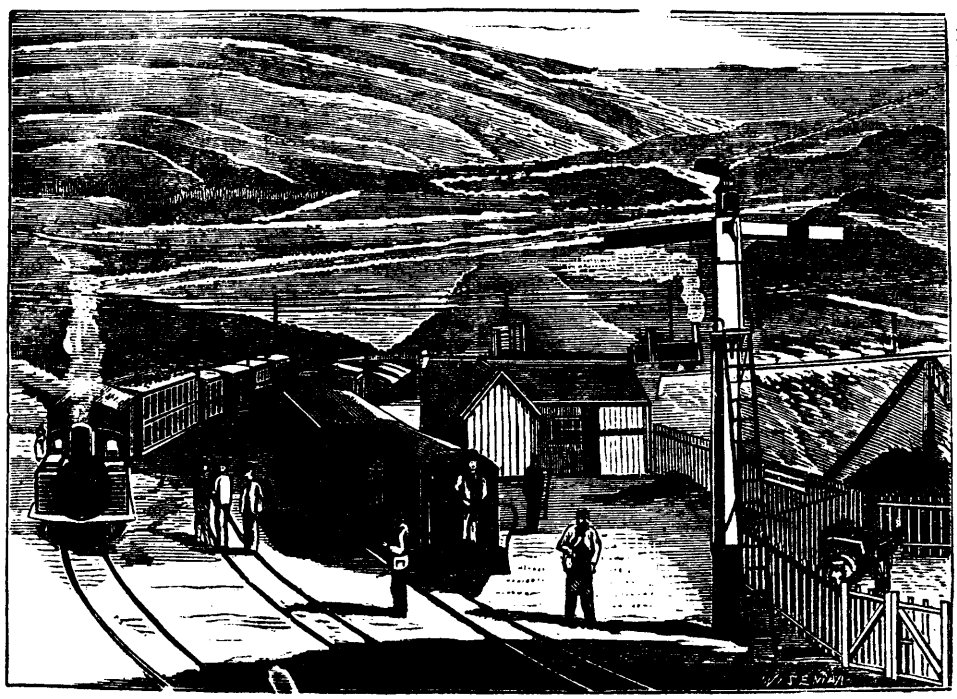
amounted to nearly $4,500 a mile: results which have assuredly not been arrived at by all the lines of 4½ ft. gauge.

The first thing to be examined at Festiniog is the rails. So important has been the proper working of this line, that of late years locomotives have been used weighing 20 tons, ensuring a speed between the stations of 31 miles an hour; to attain this result rails of 16 lbs. to the foot have been employed.

The whole of the Festiniog line may be said to lie in a series of curves, 14 miles long; and this is necessarily the case, for otherwise, the gradients would be too great. The least *radius* of the curves is 35 mètres, in lengths of 25 to 50 mètres, and others of 45, 50, and 60 mètres. The mètre equals 3'39" English feet.

Hardly any straight road occurs to separate the curves which have a contrary direction, and, at certain times when the slates are very much in demand, trains are run of 300 mètres long, which are thus sometimes engaged with three different curves at once.

Travellers are often greatly surprised that they hardly know, by the motion, that they are passing over curved lines, especially in fast trains. This result has been arrived by tracing the curves parabolically, which makes them stiffer, (raides) at the summit, but easier at the entrance, the extremities gliding, so to speak, into the alignment of the curves of an opposite direction.



Festiniog Railway.—Tan-y-Bwlch Station.

All the Engineers who have visited Festiniog have been much struck by this system of treating the curves on a narrow gauge line; and the following article, taken from "Engineering," of December 25th, 1871, will be read with interest.

"The entrance of the train into a curve, or its passgea from one curve to another is not felt. Some of our readers will accuse us of exaggeration, but none of those who have visited Festiniog will contradict us. We must confess, however, that before travelling on this line, we had read with considerable incredulity the accounts of the extraordinary ease and security with which the curves on the Festiniog Railway were traversed: but as we have really experienced this ease and security, it is only right that we should make up for our previous want of faith, by the addition of our testimony to that of others.

The trains coming from the quarries descend alone, and the locomotive that accompanies the train is to act as a check. For the ascent, each locomotive draws 130 to 150 tons of gross weight, full and empty wagons, and the trains are often 300 mètres long.

Some engineers say that this result, on a line 23½ inches wide, is a trick, or clever arrangement; but if it were intended from the first to build a line to carry such heavy freights, so narrow a gauge ought certainly not to be adopted.

It might be replied that the Festiniog Railway is a striking instance of the power to which narrow gauge lines can attain, and is the best argument that can be used to oppose the adversaries of the narrow-gauge when they assert that these roads are not capable of doing public service on a large scale.

Having previously quoted the opinion of an English engineer, it will be of interest to know the opinion of a very celebrated French engineer, Mr. Sévène, director of the works on the Orleans Railroad, who visited Festiniog in 1870:

In his lectures at the "School of roads and bridges" he says: Perhaps the most remarkable of all the narrow-gauge lines is the road from Festiniog to Port Madoc.

The line traverses a most varied route. Thanks to its narrowness of gauge and its extensive curves, it runs along the sides of the steep mountain, and sticks (léche) to the ground almost without the assistance of enbankments.

The superiority of the narrow-gauge is here made visible to the eyes of the most prejudiced, as regards the ease and economy of its instruction. It runs along the surface of the soil, across a country apparently turned topsy-turvy, where a line of the ordinary width could only go by means ofextraordinary outlay.

The construction of the stations is very simple. The wagons being very low, no platforms are needed; the buildings are of wood, and comprise an office for the Station-Master, with a trap-door for the tickets, and a waiting-room furnished with benches for the passengers.

To form an idea of the extent of business carried on by the Festiniog Railway, in spite of the simplicity of its organisation, we must study in detail a photograph of it which we reproduce below.

It is a picture of the most important station "Tan-y-Bwlch," in the middle of the line.

On the "shunting line" to the right, a mixed train of freight and passengers, which is frequently replaced by a passenger train composed of 10 carriages and an engine, and a train of empty freight wagons composed of 80 wagons and an engine, on the same line within the station, behind the other.

On the left hand "shunting line":

A passenger train descending, made up of 6 carriages and an engine.

The middle line is left free to allow a slate train to pass