

# Novel Methods of Working Steep Gradient Railways.

BY LIONEL WIENER.

**O**NE in 30 gradients, or 33 millimetres per metre, are by no means as uncommon as is usually thought, and some countries, with a well-established reputation for flatness, can often boast several such lines. In two varieties of cases are these

improved methods, but great inventions are often improved on later. This is probably the reason why 1 in 30 gradients are somewhat scarce in mountainous districts where they might be expected, and the necessity for building the mountainous lines not being so pressing, railway builders had time to



TRACK OF THE BARMEN-ELBERFELD RAILWAY OVER A RIVER.

Note the incline of the car, which is passing round a curve of 830 ft. radius, at a speed of 40 miles an hour, caused by centrifugal force.

lines to be met with frequently: in pioneering railway countries such as England, Wales and Belgium, and, more rarely, in mountainous districts. In the first case, such gradients are the penalty paid for new inventions. It is always agreeable to be amongst the first to make use of

gain considerable experience before beginning them. Besides, such lines are not obliged to pass through a number of towns and villages, and there is no inconvenience in building them pretty well anywhere within a very large area, thus allowing the engineer to reduce any inconvenient gradients.