Captain TYLER said, having been called upon officially to inspect this railway, he thought a brief description of it might be interesting to the Institution, and he noped that description would be the means of calling forth a discussion of great use, in elucidating the important question, whether it was desirable to have a narrower gauge in this country, under peculiar circumstances of locality, and having regard to the nature of the traffic. There were already in Wales, a number of different gauges used on tramways for bringing slates and minerals down to the ports of shipment; and in other countries different gauges were springing up. In Queensland, he had been informed, 100 miles were in course of construction on the gauge of 3 feet 6 inches, and 200 miles more were projected on the same gauge. It was important to ascertain, what would be a suitable gauge in those instances where the traffic was not likely to be large. Farmers were now using portable railways, for transporting the produce of their fields, for bringing in their harvests, spreading manure, &c., and there seemed no reason why districts, which could not support a railway on the gauge of 4 feet 8½ inches, should be altogether deprived of the advantages of railway communication. The question of gauge was, in one sense, a question of speed. Speaking roughly, on a railway of 2-feet gauge, with 2-feet driving wheels, travelling might be made as safe at 20 miles per hour as on the Great Western, with its 7-feet gauge and 7-feet driving wheels, at 70 miles per hour. He had travelled on parts of this little line at the rate of 30 miles per hour with every feeling of safety. He regretted the unavoidable absence of Mr. Spooner, because it prevented him thanking that gentleman, in the presence of the meeting, for the information afforded during the preparation of this Paper, and because, if he had been present, he would have been able to give further information on the subject. Mr. Spooner took great interest in this line, and was accustomed to travel on it along the Traeth Mawr embankment in a boat-carriage, not inappropriately named "Ni l'un ni l'autre," being carried along by a sail. The preliminary expenses in first applying locomotive engines, and making numerous adaptations on so narrow a gauge, were considerable; but since the line had been in working order the following results were shown.

STATEMENT of the COMPARATIVE COST of WORKING the FESTINIOG RAILWAY by HORSES, and by LOCOMOTIVE POWER.

By Horses.

	£.	s.	d.
Contract for the carriage of slates and minerals, 70,000 tons at 8*d*., the Contractor finding labour, grease, and oil	2,333	0	0
Contract per ton on 9,000 tons of coals, train, and other merchandise, ditto, at 3*s*.; the draught being ditto less journey . .	1.350	0	0
No passengers, and no cost for porterage	..		
	£3,683	0	0

By Locomotives.

	£.	s.	d.
Locomotive department (wages)	740	0	0
Materials for repairs of locomotive tender and van . . .	200	0	0
Fuel, oil, and grease required for working traffic, including oil for signal lamps, &c.	636	0	0
Additional expenses and wages keeping train in repair, over above amount by horse power	296	0	0
Additional cost in keeping up permanent way	680	0	0
Additional attendance in signal men on the horse system . .	334	0	0
Cost of working train by Locomotive	2,886	0	0
Cost of working train by Horses	3,683	0	0
Difference in favour of working by Locomotive nearly 22 per cent.	£797	0	0

Mr. G. W. Hemans said, he had seen this railway, when worked by horse-power, about three years ago, and was glad to hear now, that it confirmed the impression he then entertained, that the project of working it by locomotive power would be successful. The idea of using locomotives arose from the competition branch line, which was contemplated by the owners of the ordinary gauge lines, leading along the Welsh coast, and which branch was to penetrate into the slate district. He was called upon to examine as to the propriety of this branch line on the ordinary gauge, for the purposes of the slate quarry, and the result of his observation was, that for those purposes that gauge was unsuitable, and that no better thing could be devised than the existing 2-feet gauge. The small wagons on this gauge were carried over steep inclinations, of 1 in 12 and 1 in 15; and in some places of as much as 1 in 5, or in 6, so as to penetrate into every part of the immense slate quarries of Festiniog. The slates brought down on these extensive ramifications were expected, if the ordinary gauge branch were constructed, to be delivered at the foot of the inclines, to be there gathered together, and the narrow wagons would be hoisted into broad gauge wagons and taken to the port. This would clearly have proved a great inconvenience, and the project of using locomotives on the 2-feet gauge, as far as the foot of the steep inclines, seemed so feasible that he gave it his warm support; and the consequence of the opposition to the broad gauge branch was, that it was withdrawn, and the project of working the narrow gauge by locomotives was carried out. He thought the attainment of a fair speed by the narrow gauge locomotive was, to a great extent, as safe as on the broad gauge, provided the wheel base were properly proportioned to the engine. With regard to the economy of the working, another question arose. As to the general principle, whether it was desirable to encourage very narrow gauge lines in positions of this kind, it depended upon the nature of the traffic. He doubted whether that system could be extensively used for passengers; but where there was a large amount of mineral traffic coming out of narrow galleries, all going in one direction, and but a small passenger traffic going in either direction, he had no doubt a system of narrow gauge railways might be advantageously adopted. He thought it a matter worthy of legislative inquiry, whether this system might not be beneficially extended upon some well-considered gauge. At the same time, as a general principle, there was great objection to alteration of gauge. As regarded Ireland, the adoption of the gauge of 5 feet 3 inches had not produced beneficial results.

Sir CHARLES FOX remarked, that he had had a great deal to do with railways of various gauges. It was a subject to which he had given more attention than perhaps any other. He thought break of gauge was a serious matter; and yet it was difficult to say there never should be break of gauge. As joint engineer of the Indian tramway, with regard to which line a question arose as to what gauge should be adopted, he wrote a long report, in which he advised that that Company's lines should not be made tramways, but light railways; and, as in almost all cases such lines would be tributary to main lines, the gauge of which he believed was 5 feet 6 inches, he advised, that the tributary branches should be laid to the same gauge; but he coupled that advice with what, he thought, was an important condition, which was, that the load upon each pair of driving wheels of the engine to run on such lines should be limited to the greatest load that could by possibility come upon any pair of wheels in a train. He calculated 6 tons on each pair of wheels, and he did so for this reason; he considered that the tributary lines in India, if intended to pay, ought to be worked by the rolling stock of the parent lines. All the rolling stock of the parent lines, except the locomotives, might with safety be carried on rails of not more than 35 lbs. to the yard, but there must be locomotives of not more than about 18 tons on three pairs of wheels, or if of 24 tons, on four pairs of wheels, thus equalising the total load by placing 6 tons on each pair of wheels. But, whether the gauge was 3 feet 6 inches, 4 feet 6 inches, or 5 feet 6 inches, the rolling stock need not be comparatively heavier in proportion to the greater width of the gauge: and if the weight were restricted to 6 tons on each pair of wheels, the light permanent way would be able to do the work. The report to which he alluded, after being considered by the Directors, was not acted upon. The line between Arconum and Conjeveram, forming a junction with the Madras main line, was of the gauge of 3 feet 6 inches; but since then, the governments of the three Presidencies came to the determination, that no tributaries to main lines should in future be of any other gauge than 5 feet 6 inches. The only condition on which a narrower gauge was to be permitted, being where the line was not tributary to a main line; and even that, he believed, was not yet fully determined upon. His own opinion was, that the Government would adhere, in all cases, to the resolution requiring the gauge of 5 feet 6 inches. On the other hand, the objection to a uniform gauge for both main line and tributary branch was, as alleged by the managers of the companies, that they had no proper control over their servants; and that if a man was accustomed to drive an engine of 30 tons, on the main line, he could, if he chose, run the same engine on to the lighter road, very much to its injury; whereas, having a different gauge effectually prevented this being done. He thought, that there should be no separate establishment for the repair of those engines, but that all the locomotives should be the property of the parent company; the engines could then go to the same shops to be repaired, which would be a convenient and economical arrangement, particularly on a short branch. On the line to which he had referred, he had been obliged to send out all the tools necessary for the repair of the engines of 3 feet 6 inches gauge, whereas if the gauge of 5 feet 6 inches had been adopted, arrangements might have been made for the whole of the rolling stock to be repaired by the parent company, under an agreement with the branch undertaking. He thought it was more important to limit the weight on the driving wheels, than to fix any particular gauge, the latter being a matter which must be determined by the circumstances of each case. After a good deal of consideration on the subject, he thought if he had now to establish a gauge to be used all over the world, he should fix it at 5 feet 4 inches. The Irish gauge of 5 feet 3 inches was a very good gauge. The Indian gauge of 5 feet 6 inches was also a good gauge, but it necessitated a rather heavy rolling stock; while the gauge of 4 feet 8½ inches was in his opinion too narrow. At the same time, unless there was some strong reason for departing from the universal gauge of any country, he would follow out that gauge in even the light tributary lines.

With respect to Queensland, the government of that colony had decided beforehand upon making its lines on the gauge of 3 feet 6 inches, and the plans were referred to him for confirmation: more than 100 miles were now being constructed, and authority had been obtained for 200 miles more, the 'matériel' of which was now being prepared. In the case of the Indian branch of 3 feet 6 inches gauge, all the 'matériel' and rolling stock had been sent out from England, the sleepers being of teak. The line was laid upon an old road, which was granted to the Company by the Government, and which required some alterations in its curves and gradients. The total cost, including rolling stock, would be not quite £3,500 a mile.

With regard to the radiating axle boxes referred to in the Paper, and which had been adopted for sharp curves on the Norwegian lines, he was so satisfied with them that he was sending such boxes out to Queensland. He believed, that on the Queensland railway, 5 chains was the sharpest curve, and that 1 in 40 was the steepest inclination: that the weight of the rails was 40 lbs. to the yard, and that the engines with six wheels did not exceed 15 tons in steam, ready for work, exclusive of their tenders, carrying fuel and water.

The most important reason for using the narrow gauge, in this instance, was for the construction of circuitous lines through mountain ranges, where it was impossible, except at very great cost, to have curves of long radius. If it had not been for the sharp curves, he would not have recommended the narrow gauge for the Queensland lines; and it must be borne in mind, that these being the first railways in that colony, there was no existing gauge to which the gauge of these lines had to be adapted. He hoped, however, that his remarks did not lead to the supposition that he would lay down a railway, with a gauge of 5 feet 6 inches, to a slate quarry in Wales; his observations applied only to such lines as were tributary to main systems of railways.

Mr. Peter Bruff remarked, that all the Norwegian lines alluded to, were isolated. The original line, made by Mr. Stephenson and Mr. Bidder, had been extended to the confines of Sweden, and was entirely constructed on the guage of 4 feet 8½ inches, with which the other lines of the country were never likely to be brought into communication. Radiating axle boxes, he understood, had been recently introduced on the Norwegian lines with considerable success; the weight of rails generally adopted was 37 lbs. to the yard, laid in lengths of 21 feet, the rails being flat-bottomed, 3½ inches high, with a base of 3 inches, laid on cross sleepers, and fish-jointed. In some cases, a plated joint had been used, which, from the experience obtained in England, was not considered a desirable arrangement. Upon the subject of narrow gauge Norwegian railways, he had, however, received a communication from Mr. Pihl, who, in 1856, was intrusted by the Norwegian Government with the task of supplying railway communication between Throndhjein (about 350 miles northward of Christiania) and Storen, the point from which two main carriage roads ran south; and between Hamar, on the Lake Mjosen, about 56 English miles north of Christiania (with which it was in direct communication by rail and steamer), proceeding eastward to Eleverum, upon which the traffic of the Glommen Valley converged. Mr. Pihl stated, that he determined, from the difficulties of the country and the smallness of the traffic to be accommodated, that he should not be justified in recommending such an outlay as would be involved by the formation of a railway as ordinarily constructed; he therefore recommended a gauge of 3 feet 6 inches. This was adopted by the Government and confirmed by the legislature (Storthing) in 1857, and shortly afterwards the works of both lines were proceeded with.

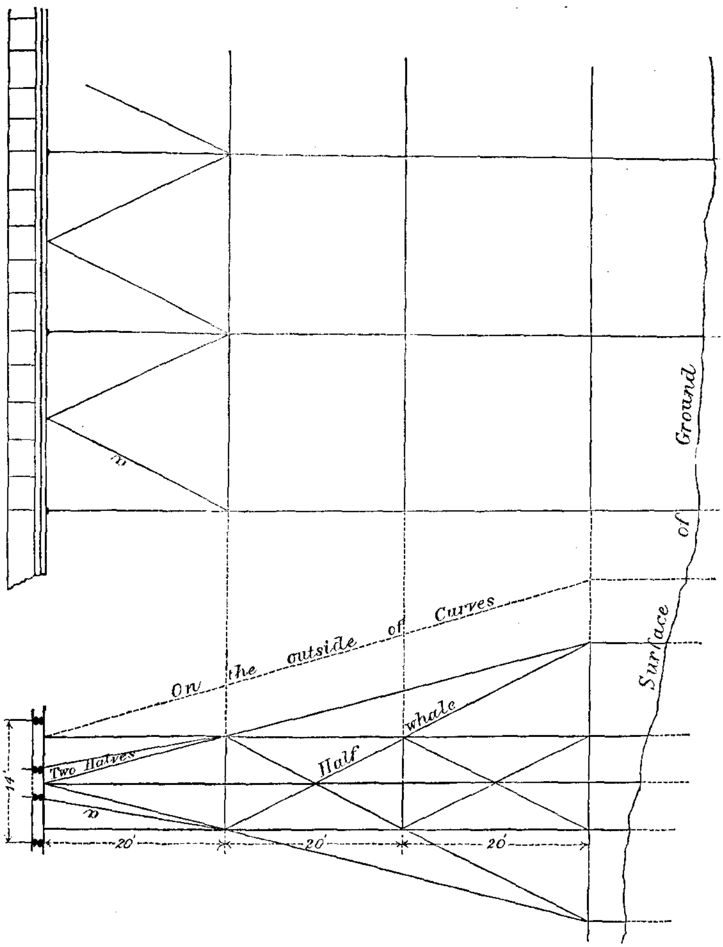
The works upon the Hamar line, being the more easy of construction, were sufficiently advanced to be used for goods traffic in the summer of 1861. The total cost of this line, for 24½ English miles, had amounted to about £3,000 per English mile. This included a large iron bridge, on stone piers, about 900 feet long, for ordinary road purposes only; the rolling stock of 3 locomotives, 6 passenger carriages, 3 break vans, and 50 goods wagons, with the necessary ballast wagons and tools for repairs; also two terminal stations, and six intermediate stations and stopping places, a carriage shed and a small repairing shop. Although the works were not of a heavy character, there were nevertheless many difficulties to contend with, the line having to ascend upwards of 400 feet, and to cross extensive and deep swamps.

The Throndhjein line of 31½ English miles, running through a difficult country, required many heavy works of construction, among which were numerous large bridges, some being from 70 feet to 100 feet high, several cuttings containing from 50,000 cubic yards to 70,000 cubic yards each, and others through rock of more than 30 feet in depth. The cost of this line was necessarily greater than the former, in all about £5,000 per English mile, including 4 engines, 8 passenger carriages, 3 break vans, 60 goods and plank wagons, beside 20 ballast trucks, with the necessary implements for repairs. There were besides the terminal stations, six intermediate stations and three stopping platforms. At Throndhjein there were also goods and carriage sheds, and a workshop for the repair of the rolling stock. This line had to cross a ridge more than 500 feet in height, in the first Norwegian mile from Throndhjein. The greater part of this distance was constructed on one side of the ridge, with gradients of 1 in 42 and 1 in 65, and on the other side of 1 in 52, the curvature being of about 900 feet radius; whereas on the other portion of the line, where the gradients were seldom more than 1 in 100, curves of 750 feet were frequently resorted to. The width at the formation level in cuttings and on embankments was 13 feet nearly; the slopes, according to circumstances, were from 1½ to 1, to 3 to 1. The ballast was 8 feet wide at the top, and 1 foot 9 inches in thickness: the sleepers were of half round pine, 6 feet 6 inches long, placed 2 feet 6 inches apart on the curves and steep gradients, and 2 feet 9 inches apart on the straighter portions of the line. The rails were flat-bottomed and fished at the joints in the usual way, 3¼ inches in height, and weighing 37 lbs. per yard, except on the steep inclines, where rails of 41 lbs. per yard were laid. The rails were fastened to the sleepers by dog-spikes only, no bolts or bottom plates being used. Ransomes' chilled crossings, and Wild's self-acting switches were used throughout. The bridges were all of timber, except where large rivers had to be crossed, and spans of from 50 feet to 100 feet were required, in which case stone piers were carried up above flood level. The superstructure made use of in those cases was Howe's system of trellise work, with iron suspending rods. For the other bridges and viaducts a plan similar to that shown in Fig. 1, Page 374, was generally adopted, and though of light and cheap construction, it had proved very satisfactory with regard to stiffness and solidity, even at heights of more than 90 feet. The rolling stock consisted of tank engines with three pairs of wheels, two pairs being coupled for drivers, these having an available weight for traction of from 11 tons to 12 tons, out of the 14 tons to 15 tons, the total weight. The last engines procured were provided with bogies, on Bissel's or Adams' system. The cylinders were 10 inches in diameter, with a length of stroke of 18 inches, and the driving wheels were 3 feet in diameter. All the engines were made in England, with the exception of one made at Throndhjein, and were working efficiently. The passenger carriages were constructed to carry the usual number of passengers, as in England, and were arranged for two classes only, the compartments being fitted up as first and third. The goods wagons were made to carry 5 tons, and were only a few inches narrower than the ordinary kind, these widths being obtained by having the springs attached to brackets inside the sole bars, thereby allowing the lowering of the body, and in consequence, the centre of gravity. The buffers were all central, and 2 feet 6 inches above the rail level, and served also as draw-bars. The couplings on those last constructed were self-acting when the wagons were brought together. As this narrow gauge allowed a correspondingly larger wheel base than the ordinary gauge, the wagons ran very steadily. Some of the wagons were constructed to carry planks $24\frac{1}{2}$ feet long, and had a length of wheel base of 13 feet.

The usual rate of speed was about 15 miles per hour, including stoppages, and the trains ran quite as steadily on this line as on the broader gauges. The traffic on these lines, though considerably below that of the lowest of the English lines, had already fully paid the working expenses, while the impulse given to the development of the resources of the country must undoubtedly, in course of time, produce a corresponding and satisfactory increase of revenue.

In order to show the economy of construction, Mr. Pihl mentioned, that simultaneously with the construction of these lines, an extension of about 50 English miles was constructed, from the old trunk line built by Messrs. Stephenson and Bidder in 1850-53

Fig. 1.


On the outside of Curves
Two Halves
Half whole
Surface of Ground
14'
20'
20'
20'

to the Swedish frontier, of the ordinary gauge of 4 feet 8½ inches, the cost of which was about £6,400 per English mile, the rate of wages and the class of work being, as nearly as possible, of the same description.

In addition to the two narrow gauge lines described, there was in course of construction, another line of the same gauge, between the town of Drammer and the Lake Randsfjorden, about 57 English miles in length, besides several branch lines in preparation. None of these several lines would ever have been made, had not the small cost justified and encouraged the undertakings.

Mr. Pihl added that, last summer, Mr. Charles D. Fox inspected the narrow gauge lines in Norway. All the details, with the engines and rolling stock, were unreservedly placed at his disposal; and on leaving he wrote—"With reference to the interesting question of the 3 feet 6 inch gauge, I shall return convinced of the thorough efficiency of such a gauge for the purposes of a new country, and of the wisdom of adopting such a gauge where the traffic is not very heavy."

Mr. PHIPPS inquired, whether the economy of these narrow gauge lines did not consist chiefly in the diminished cost of construction, rather than in working the traffic of the line? In his opinion, the cost of haulage per ton could not differ much, whatever the gauge might be; but as regarded the construction of the line, it would, of course, be less for the narrow way. These narrow ways were obviously suited for mountainous districts, where the curves being necessarily sharp and frequent, it became important to reduce, as much as possible, the friction arising from wheels keyed fast upon the axles, which was obviously done by diminishing the width of gauge. On tolerably level ground, with the ordinary alternations of cutting and embankment, where the slopes formed so large a proportion of the whole earthwork, the saving from narrowing the gauge would probably not be considerable.

Mr. BRUFF replied that, though considerable economy in the earthworks arose by adopting sharp and reverse curves on the Norwegian lines, the bridges and viaducts were extremely heavy, so much so, as to have astonished him when he was informed of the prices at which the lines had been carried out. No doubt, the economy of construction was greater than if a heavier rolling stock and permanent way had been employed throughout.

Mr. GREGORY, V.P., remarked that, with the narrow gauge, a shorter wheel base of the engines could be adopted, which gave greater ease in traversing sharp curves.

Mr. ROBERT MALLET said, as yet no mention had been made of another narrow gauge line, which had been a long time in successful operation, viz., that between Antwerp and Ghent, the gauge of which, he believed, was only 2 feet 3 inches. He could not give the precise particulars of the rolling stock, but could state generally, that the carriages were wider than those on the Festiniog Railway, and that they carried heavier loads.

The subject of narrow gauge lines was not new to him. About eleven years ago he recognized the advantages, in respect of cheap railways and traffic, which would arise from narrow gauge lines; and in 1855, he had proposed to Mr. Hemans a line along the north shore of the Bay of Dublin, to have a gauge of only 2 feet 6 inches. That project, for reasons it was not necessary then to go into, was not carried out; a bill, however, was presented in the present session of Parliament for a similar line, and he hoped it might be made on the narrow gauge. In viewing the question of narrow gauge and ordinary gauge railways, it was necessary to consider, what he might call the prudential considerations, those that related to the circumstances of traffic, &c., separately from those which were of a purely physical character. He met in Sicily last year Colonel Yule, late of the Bengal Engineers, and he had had many opportunities of discussing with him what had passed relative to Indian tramways, or branch railways. Colonel Yule's opinion was decidedly in favour of narrow gauges, and he considered that in India it was simply a question between the bullock-cart, or these narrow-gauge lines, as feeders to the trunk lines. Reverting now to the purely physical considerations, it appeared to him, as a physical necessity that, not only the original cost of two similar lines differing in gauge, but also the cost of working them, would approach the ratio of the cube of the length of axle, or what was the same, of the breadth of gauge. A little consideration would show that, however startling, this proposition, without having any pretensions to be a mathematical truth, was nevertheless approximately true. As an illustration of this—if the axle of a carriage, as a cylindrical shaft, exposed to cross strains, were taken, it would not admit of dispute, that for equal strength, on different gauges, the diameter must vary as the cube of the length, or of the gauge; therefore the weight of the axles would be in that ratio, and so must be that of the wheels to carry them. Then as to the carriages, as it was equally undeniable that the weights of any similar structures whatever, varied as the cubes of their homologous dimensions, so the weight of the carriages would be as the cubes of the gauge, if the carriages were of equal lateral strength: and the axles and wheels must be proportionate to carry this load. In a word, all the rolling stock would be increased in something like the ratio of the cube of the gauge. If this were so, it followed, that the permanent way itself must be increased in a proportionate ratio to bear that load; and if it were true, that the cost of haulage was a function of the weight drawn, it equally followed, that the rolling expenses, or those for working the line of road, would be about in proportion to this increased weight of rolling stock also. He wished to guard against being mistaken as now speaking mathematically, or as using the cube as a precise expression of the relation; his intention was merely to illustrate the proposition which he deemed generally true—that not only the first cost of construction, but also the expense of working railways, increased with the width of the gauge, but in a greatly higher ratio, or in other words, that in proportion as the gauge was reduced, both the first cost and the working expenses would be diminished. There were some special physical advantages in narrowing the gauge; for example, engines, or carriages could go round a sharp curve more easily with a 2-feet gauge than with a 7-feet gauge: this fact had had some doubt thrown on it, but its truth was obvious, from the consideration, that if the two rails could be brought close together, or into one, there would be no longer any resistance at all in going round, due to the outer wheels and inner wheels having to go over different lengths of curve in equal times.

Mr. Savin said, he had not at first imagined that a line of so narrow a gauge as the Festiniog Railway, could be worked successfully with locomotives; but he had travelled on that line both with locomotives and in the boat carriage, and he thought it a great success, both in regard to its adaptation to the circumstances of the locality, and in its commercial results. He agreed, that the gauge of railways in any one country should be uniform, as far as through systems of working were concerned; but, having had some experience in Wales, he thought it impracticable to carry out the broad gauge in that country. He had seen various gauges in operation, from 2 feet up to 3 feet 6 inches; his own feeling was in favour of 2 feet 3 inches, or 2 feet 6 inches, where the valleys were crooked and steep sided. In this way many physical difficulties might be avoided, by the adoption of curves of shorter radius; a 2-feet gauge line might be fitted to the contours of the hill sides, in such a manner as to reduce the cost of railway communication to a minimum. A line 16 miles long, for which he had given £20,000, was laid on the gauge of 2 feet 3 inches, and that line had been extended into a district similar to that which the Festiniog Railway passed through. There would have been very little chance of carrying a bill for a railway on a gauge of 4 feet 8½ inches in that district, and the result would have been, that but for this class of railway, the present development of the mineral resources of those valleys would not have been attained; and it was especially with reference to districts such as this, that the subject was worthy of the fullest consideration on the part of Engineers.

Mr. G. P. Bidder, Past-President, said he had listened to the

Paper with great interest. It was an evidence that the Author, as a government official, had a view to the commercial results of railways. This system was not propounded as a measure of economy, in other respects than that there were cases in which the economy of constructing the narrow gauge should be considered, where it could be introduced, for the sake of the curves and gradients, in districts where the broader gauge could not be introduced. That was the only ground on which this question could be fairly considered; but the Author did not pretend that a narrow gauge could be worked more cheaply than a broad gauge. The arguments adduced in favour of the economy of working the narrow gauge, if followed out, would lead to the conclusion—that if there were no gauge at all, a railway could be worked for nothing. The question was, not the cost of moving a carriage, but at what cost a ton of minerals, or coals, or a hundred passengers could be moved. As a matter of practice, a ton of minerals, or a hundred passengers, could not be moved on a narrow gauge more cheaply than on a broad gauge. That it was so in this case was shown in the figures given in the Paper; for, although the substitution of steam traction in place of horses was undoubtedly a proper thing to do, yet he did not understand the Author as propounding the question of these narrow gauge railways to show that the cost of working, ton for ton, and passenger for passenger, was any cheaper than working on a broader gauge; the Author said distinctly, he did not propose this narrow gauge, except in isolated places—as in the instance given between Festiniog and Portmadoc, where the railway took the slates from the quarries to the ships, and had no connection with any other railway. But a break of gauge, whether in India, or elsewhere, was an avowed evil, and could only be reconciled by the advantages of economy of construction, as compared with the cost and inconvenience of trans-shipment. As to these railways, he had no doubt for short branches, or extensions, or even for village lines, it might be useful to introduce them. But in this country there were what were called the "Standing Orders of Parliament," which interfered very much with such lines. Engineers were allowed to deviate 5 feet vertically in open country, and were restricted to 2 feet in towns. Anything more absurd than that, it was impossible to conceive. In the neighbourhood of London, where the country was flat, a limit of 5 feet might be suitable; but in districts where the inclination of the surface of the ground was 1 in 5, or 1 in 6, the 100 yards of lateral deviation might change the work from cutting to embankment; and the 5 feet might require to be 20 feet, or 30 feet. Parliament said "A railway shall not cross a public highway in this country if it interfered with its level, excepting it be made with a gradient of 1 in 20 for a parish road and 1 in 30 for a turnpike road; nor shall it cross a road on the level, without permission." Of course, these were questions of local circumstances: 1 in 20 might be a proper gradient for London; but there were districts where the normal gradients were 1 in 7, or 1 in 10, and where the traffic might amount to three vehicles, or four vehicles per day. No attention was, however, paid to that fact, nor were reasons listened to—but a gradient of 1 in 20 was insisted on. He had had to say, on one occasion, in committee, that if such conditions were to be abided by he could not prove the preamble, for the gradient of the valley being 1 in 11, 1 in 20 would go quite across the valley. But what he proposed was, to spend £500 in improving the road on the other side of the railway, leading to the nearest village, and then the bill was passed.

With regard to level crossings, he feared he had been a great offender, for on one line he had as many as thirty-eight level crossings on as many miles of railway. But now the rule was, that there should be no level crossings. In consequence of this, where the Great Eastern Railway crossed a country road at its apex, at a most convenient place for a station, especially for minerals, the Engineer was compelled to avoid making a level crossing, though it was near the highest point of the country, and to raise that road 15 feet or 16 feet, at a cost he believed of £7,000 or £8,000. The Company could not have a station there, the opening of the line was delayed for several months, and the thing was a nuisance to the neighbourhood.

He offered these remarks, because this Paper showed, that the Author's mind was directed to commercial results. He said in effect "where the broad gauge is inappropriate have a narrow gauge." He agreed with him; but the question of commercial consideration entered as much into broad as into the narrow gauge railways, and regard must be had to the local circumstances where each gauge might be applied.

Mr. E. Woods thought it was evident, from the observations which had been made, that no one system could be laid down, nor any one gauge be fixed upon, as applicable to all conditions of locality, traffic, &c., but that each district must be treated according to its circumstances. With regard to the Indian gauge of 5 feet 6 inches, he could quite understand, it was most desirable to construct branch lines on the same gauge as the main lines, and in a flat country like India the difference of cost as between a gauge of 5 feet 6 inches and a narrower gauge would not be great, the principal item being in the additional length of the cross-sleepers. The rails might be lighter than those of the main line, and the engines for working the branches made light in proportion. Six years ago he had to construct a railway in Chili, 27 miles in length. The line was situated in the lower range of the Andes, where the gradients were necessarily severe and the curves sharp. Here curves of 500 feet radius in combination with gradients varying from 1 in 20 to 1 in 30, constantly occurred. It was said, by the Engineers of the country, that it would be impossible to work that line with locomotives, and accordingly it was laid out for mule traffic, and it was worked by mule power for eighteen months. But owing to the seasons of drought and other causes, the expenses of working were so high, that a decision was come to by the Directors, to work the line by locomotive power. He was called upon to design the engines, and in his design he limited the weight on the driving wheels not to exceed $7\frac{1}{2}$ tons, but the difficulty was to get sufficient adhesion to take the loads up the severe inclines of 1 in 20 for 7 miles, and of 1 in 30 for 12 miles. That difficulty was overcome by putting 6 driving wheels to the engines, and placing the front end on a bogie truck. The rails, of 42 lbs. to the yard, had stood exceedingly well, and up to this time were in good working order, for though the engines weighed 30 tons, the weight, being distributed over so many wheels, had produced no sensible injury to the rails. The ordinary working speed on the inclines was about 12 miles per hour.

From the experience of the working of that line, it was evident that railways of light and inexpensive construction might be advantageously worked, if due regard were paid to the adaptation of suitable rolling stock.

Mr. W. Bridges Adams said, in dealing with the question of light railways, there were two aspects from which to regard them —the commercial and the mechanical. The latter might be a toy, but the former must have reference to utility. The object being to transport materials and men, there must be sufficient volume in the carriages and wagons to hold them conveniently. Now, it was not convenient to have the dimensions so reduced as to render it necessary to strap the passengers to the seats to prevent oversetting. It was quite true, that the narrower the gauge the shorter might be the distance between the axles, if rigidly parallel, so as to facilitate passing round sharp curves; but, on the other hand, the longer the vehicle the steadier would it run, and the rigid structures which formerly needed straight lines of way, or very flat curves, might now cease to be rigid, by provision being made for the axles to radiate on curves, and point truly to the centres of those curves. By this arrangement, and by the use of spring tires, permitting the wheels to slip within the tires, it was now practicable for carriages, or engines, with extreme wheels 25 feet apart, to roll without rail friction round curves of 2 chains radius, and this fact rendered the width of gauge, whether 2 feet or 7 feet, a matter of indifference as regarded curves. On the

Norwegian line of 3 feet 6 inches gauge, engines of that class were now working.

In considering the cost of gauge, the saving could not be in the rails, but only in the length of the sleepers, and the quantity of ballast, bridges, &c. The axles might be shorter, and material might be saved in length of cross framings, but it did not follow that this was economical. With a given load, there was a certain space required to stow it, and there was a certain proportion of length to breadth of train which gave the best results in traction. A long narrow train was disadvantageous and especially so on very sharp curves. The proportion of the width of rail gauge to the width of the carriages was another consideration. As a mechanical rule, the carriage bodies might be safely made double the width of the gauge. Beyond that width there would be a tendency to unsteadiness. A 2-feet gauge, by that rule, would only admit a carriage 4 feet wide, and that, even with passengers back to back, was very cramped. Again, with passengers so placed, 3 feet in length of the carriages would only carry four passengers. While seated fore and aft, eight passengers could be carried in a 4-feet length of carriage, with a 3 feet gauge of rails, *i.e.*, one-fourth increase in length of train would double the number of passengers, or volume of goods.

With a 2-feet gauge and wheels 2 feet in diameter, the boiler and framings should be carried above the wheels altogether. With a gauge of 3 feet 6 inches, the boiler might be between the wheels; and engine-wheels of only 2 feet in diameter seriously damaged the rails if heavily loaded. If of larger diameter, better adhesion might be attained. The worst gradient on the Festiniog line appeared to be 1 in 60, but with heavier gradients heavier engines would be needed, and there was now no difficulty in constructing engines with eight drivers to roll round curves of 2 chains on any gauge. The very important feature in the engine described was the great pressure of steam—200 lbs. to the inch.

There was no doubt that narrow gauges might be made at less cost than wide ones, but it was doubtful if any material saving could be made by reducing a 3-feet gauge to a 2-feet gauge, when it was considered, that the upper structures of the train must be provided with sufficient space for convenience.

There was one reason why it was desirable to make branch lines of a narrower gauge than main lines when the traffic was light, viz., to prevent heavy engines and vehicles from running on them and destroying them. But in the coal traffic it was desirable, and possible, to employ wagons of the greatest capacity and length, capable of running round the sharpest possible curves and up to the pit's mouth, and in this case it was better to have no break of gauge. On a gauge of 4 feet $8\frac{1}{2}$ inches, it was quite practicable to use 8 wheel wagons, 40 feet long, by 9 feet wide, with an internal capacity of 1,500 cubic feet.

Mr. Gregory, V.P., said, he was prepared to recognise the propriety of the measures adopted on the Festiniog railway, under circumstances which, he thought, were special and peculiar; but the Institution and the profession would be bold if they attempted, on the data now before them, to adopt, as had been suggested, the idea of a supplementary narrow gauge for all small branch lines. He believed that the advantage of such a gauge was limited to local conditions, such as those described in the Paper. There was an old line, having branches into several slate workings, and on account of the gauge already existing in those workings, and the character of the works and the curves of the Festiniog railway itself, it would have been exceedingly difficult to adopt the ordinary gauge; therefore the managers had endeavoured to make the most they could of an exceptionally narrow gauge, by converting the main line into a line for general goods and passengers. They also did well to introduce locomotive power on the line; but all who heard the Paper must feel that this was done under difficulties. He must record his protest against the theory, that the cost of the working expenses of railways was in proportion to the cubes of their width of gauge. The quantity of goods, or the number of passengers to be carried, was an essential element in such a question, and he thought that it might with as much correctness be affirmed that Messrs. Pickford could carry on their business more cheaply in costermongers' carts than in their usual vans. This illustration would show that such a theory could not be practically supported. He was sure while Mr. England had got work out of an engine, under difficult circumstances, with an exceptionally narrow base, that gentleman would state that he could obtain greater power, and more economy for a large amount of work, if he had a wider base to work upon.

In considering the circumstances under which an exceptionally narrow gauge might be adopted, it became necessary to investigate its supposed advantages. Setting aside the idea of any saving in working, when there was anything beyond a very limited traffic, these advantages appeared to be classed principally under two heads, viz.: firstly, a saving in cost of construction, and secondly, the easier use of sharp curves.

What had been done on the Festiniog Railway to make the most of its capabilities did not point to much saving in first cost; indeed it seemed, as had been remarked, that the saving would extend to little beyond sleepers and ballast. It was pointed out in the Paper, that to make the most of the wagon and carriage room, the rolling stock overhung so far, that a width of 4 feet 6 inches was required between the rail and any bridge piers, and a 7 feet space between any two lines of rail; the result would be the necessity for a minimum structure width for a single line, of 11 feet, as compared with 12 feet 8 inches on the ordinary gauge, and for a double line a width of 20 feet, as compared with 23 feet 5 inches in the ordinary gauge of 4 feet $8\frac{1}{2}$ inches. Such a difference would produce so small a saving in the cost of the works, as not to compensate for the disadvantages of having a very narrow wheel base, which would limit the power of the engine, and in the event of derangement of the permanent way, would cause such unsteadiness in running, that the speed common on ordinary railways would be dangerous.

With regard to curves, the friction arising from the different length of the arcs of the outer and inner rails was greater on a broad gauge than on a narrow gauge, and as rolling stock was at present generally constructed with rigidly parallel axles, the most obvious advantage of an exceptionally narrow gauge was the smaller radius of curves that might be adopted. But, he thought, modern improvements were going far to overcome the difficulties of sharp curves, and he recognised the great value of such inventions as Mr. Adams' radial axles, by the application of which to the ordinary engines and rolling stock of the country, trains might run round sharp curves on the ordinary gauge as freely as on a narrower one.

As these two supposed advantages seemed likely to disappear, he therefore concluded, that seeing the loss which took place by the uneconomical application of the power of the engine, the fact that the ordinary gauge admitted of rolling stock, which would bear a smaller proportion of dead weight to the weight carried, and last but not least the evils of a break of gauge, it might be concluded, that if there was to be an exceptionally narrow gauge in this country, it could only be advantageously applied to exceptional cases.

Mr. T. E. Harrison said, he entirely agreed, that it would be absurd to say, because this narrow gauge had been successful in its application in a particular state of things, therefore it was applicable generally. The particular case where it was applied was one in which the main traffic of the line was in slates, and the trucks were taken to where the slate was quarried, and where no large wagon could go. The slate was unavoidably brought down inclined planes in narrow wagons; and if the gauge of the main line had been broad, must have been reloaded into broad-gauge wagons. At Portmadoc the slates would have to be again transferred from the wagons to the ships alongside the quays: this narrow gauge was, therefore, unquestionably the best means of conveying them to the port of shipment. As to the mode adopted for the conveyance of passengers, no doubt it was ingenious, and people travelled on the line with a good deal of comfort; but the works were so narrow, that when the train was standing still in a cutting, a passenger could hardly make his way past the edges of the carriages. That was not a railway which could be taken as a sample of what was desirable. It was a clever adaptation of a state of things which previously existed, and which had been designed with a different object, and as far as it went, it was exceedingly good; but to suppose that the principle upon which it was constructed was to be applied to an unlimited extent where railways of the ordinary gauge existed, was a total fallacy. It was possible that there were exceptional parts of the country where such a system might be adopted; but at the present moment such an instance did not occur to his mind. He knew there was an intention to employ the narrow gauge in other slate-quarries; but those were particular cases, and he thought, if the Institution gave its sanction, in any shape or way, to the extension of the system to general traffic, it would be leading the public in a wrong direction.

Mr. Alfred Giles remarked, that it was some years since the battle of the gauges was fought, and he had scarcely expected a fresh campaign to be opened in this Institution in favour of a 2-feet gauge.

The 7-feet gauge was known to be too wide. Mr. Hemans had observed that the Irish gauge of 5 feet 3 inches was wider than was necessary, and Sir Charles Fox had said, that if he had had his own way in India, he should have preferred to have laid the branch lines on the national gauge of this country instead of on the gauge of 3 feet 6 inches. This proved, that the old gauge was not far from the right thing. The advantages claimed for the narrow gauge were, first, great facility in traversing sharp curves; secondly, economy in construction; and, thirdly, the use of lighter rolling stock. The first two points had already been disposed of. He remembered seeing in Paris, some years ago, a little railway with a gauge of 4 feet $8\frac{1}{2}$ inches running in a circle, the radius of which, he believed, was only 25 mètres. He had seen trains run round that line with great facility; and if that were so, where was the necessity for making a 2-feet gauge to save a little in the radius of the curve? It was stated that the least curve on the Festiniog line had a radius of 2 chains, or about 40 mètres. As to first cost, it had been shown that the economy could result only in a little shortening of the sleepers, and a little saving of ballast. This could not be put down at more than £300 a mile. Then as to the weight of the rolling stock, credit was claimed for the engine being only $7\frac{1}{2}$ tons weight; there was no reason why an engine of similar weight (plus a little extra for the longer axles) could not be applied to the ordinary gauge. But it had been asserted, that the weight of the rolling stock was increased as the cube of the gauge; if that were the case, the weight of the Great Western broad-gauge engines should be 343 tons. Looking at all these circumstances, it was clear that the national gauge was nearly the best that could have been chosen. On an ordinary road, where there was no limit as to gauge, carriages had a width of about 4 feet 6 inches, and even the smallest cart was wider than 2 feet; he hoped, therefore, that Engineers would not adopt the idea that the 2-feet gauge was an example to be copied, when they knew, as had been remarked, that a break of gauge was a great public inconvenience.

Mr. J. J. ALLPORT, having had many years' practical experience in the working of railways, would offer but one observation upon this very narrow gauge. For reasons which he would state, he was of opinion that it would be most objectionable to attempt to introduce it into the country generally. With respect to the existing broad and narrow gauges, it was well known to all practical men, that the weight of a train on the narrow gauge was as great as on the broad gauge, or rather, that engines could be constructed to take as great weights on the narrow gauge as on the broad gauge; and if engines were made much heavier than at present, various difficulties, such as of wear and tear, would arise. But there was one difficulty greater than all: the principal part of the work of a train was at the stations, in the loading, unloading, and moving of trucks and carriages from one part of a station to another, across turn-tables or traversers; and any one who had had experience at a station worked upon the mixed gauge, or solely upon one or other of the gauges, must have been struck with the great additional expense in working the broad-gauge plant at the stations. It was not difficult for a couple of men to move a narrow-gauge truck or carriage to any part of the station; but to shift the broad-gauge plant, horses must be employed. The capacity of the goods wagons and coal trucks upon the narrow gauge had been gradually increased from about the size of the Newcastle chaldron of 2 tons 12 cwt. up to 8 tons, 9 tons, and 10 tons, for the load; but, he thought, all narrow-gauge managers had come to the conclusion that, from 8 tons to 9 tons for trucks was the maximum load that should be carried on the narrow gauge, with a due regard to economy and safety. If that weight for the load was exceeded, the wagon itself had to be made so much heavier, and then the friction was considerably increased, causing hot axles and other objectionable results, so that it was not uncommon to see these heavy wagons standing under their load, at various sidings and stations, and waiting to be repaired. On the Midland Railway there were between 17,000 and 18,000 coal trucks at work; for a long time the capacity of these trucks was limited to 6 tons: now the capacity had been increased to 8 tons; but the Company did not approve of greater capacity than that. He was of opinion, that for all practical purposes the gauge of 4 feet 8½ inches was the best, and superior to either the broad, or the narrower gauge. But there was another important consideration: if a very narrow gauge were adopted, it could only be on branches connected with main lines. That would involve, in all cases, trans-shipment of passengers, goods, and coals, at the junctions; and, in itself, would cause a greater annual expense than the interest upon the increased first cost of the line upon the uniform gauge of the parent lines, both in the purchase of land, and the construction of rolling stock. That was a fatal objection to the introduction of any gauge, other than that of the line with which these branches were connected. He had no doubt that in a very few years the gauge of 4 feet 8½ inches, as being the best adapted to the commercial wants of this country, would be the only one in use.

Mr. Zerah Colburn said this Paper raised the question, how small could a locomotive be made to give practically useful work? In 1852 the contractor for a portion of the works on the Great Western Railway of Canada employed the steam excavator, which no doubt many present had seen in former days on the Eastern Counties line. For that purpose he proposed to lay the temporary line on the 3 feet 3 inches gauge, and wagons were built to hold each 15 cwt. as a load. Mr. Colburn designed and built a small 4-wheel tank engine for working those wagons, and six other similar engines were afterwards built. The tank was placed under the boiler between the frames, and as the gauge was so narrow, the fire-box was placed behind the driving-wheels, and to correct the overhanging weight, the tank was carried as far forward as possible. These engines weighed 6 tons only, with fuel and water, and could be easily taken apart, for carriage over common roads, into three principal portions, of which the heaviest weighed hardly more than 2 tons. The cylinders were 9 inches in diameter, with a length of stroke of 16 inches; and the wheels, of 3 feet diameter, were placed 4 feet 6 inches apart from the centres. The engines worked well, although of course only at moderate speeds.

Mr. James Brunlees knew the Festiniog Railway well, and though he did not question the success of working locomotives on so narrow a gauge mechanically, he much doubted its success commercially. On the other hand, he believed that, beyond a certain limit, the wider the gauge, the less would be the dividends: he looked upon that as an established fact. Some years ago he constructed a narrow-gauge line from Portmadoc to

Gorsedda, the length of which was 8 miles, and the gauge 3 feet: the total rise in the 8 miles was 900 feet, and the cost per mile, including land, was £2,000: the sharpest curve had a radius of 400 feet, and the down loads were worked entirely by gravitation; but passengers were not carried on the line; and although he had advised this line to be made on a narrow gauge, he was not prepared to recommend its further adoption, unless for exceptional purposes, or for purposes similar to the one in question. The want of uniformity of gauge was a great drawback to traffic in many parts of this country, and hence any departure from the ordinary gauge would perpetuate and augment that drawback.

Mr. GALBRAITH said, there was one principle involved in the Paper which had been lost sight of in the question of the gauges: that was—was there no room in this country, particularly in the agricultural districts, for cheaply constructed railways on the gauge of 4 feet 8½ inches? He thought there was. There were many cases where, by adopting sharp curves and a light permanent way, with light engines and level crossings at public roads, a railway might be laid down for £4,000 or £5,000 per mile, which would pay a fair dividend upon the outlay; and he hoped it would be impressed upon the members of the Board of Trade, that in respect of branch lines, on which the traffic was light, they ought to relax the stringent requirements with respect to expensive permanent way, and costly works to avoid level crossings. He had been engaged in laying out a line in Devonshire, of the character he suggested. If heavy earthworks and bridges were to be encountered, it was impossible that the line could be constructed to pay a dividend at all. In parts of Devonshire there were small public roads the traffic on which did not exceed two vehicles or three vehicles per day. To maintain, at a heavy cost, the principle of avoiding level crossings in such cases was, he thought, unwise. In many cases, railway companies erected cottages along the line for the platelayers to be near their work; and there could be no objection to the wives of the men attending to the gates at such level crossings, in consideration for living rent free. He thought curves of 10 chains or 12 chains radius, and level crossings where the public traffic was light, might be fairly admitted on branch lines, which, when constructed at £4,000 or £5,000 a mile, might be made to pay a dividend. In such cases, a light rail of 40 lbs. or 50 lbs. to the yard might be laid down, which would carry the ordinary carriages, if not the ordinary engines; but for short branches of 10 miles or 12 miles, one engine or two engines might be specially provided by the company, to work the branch alone. Such a plan as that was far preferable to an exceptionally narrow gauge causing a break between the branch and the main line, and the consequent trans-shipment of the traffic, and the supply of fresh plant in the shape of carriages and wagons to work the traffic when so transferred. This question having been now fairly raised, he thought it was a point which ought not to be lost sight of, and which was well worthy of consideration.

Mr. Peter Barlow said, that though he was not of opinion that the gauge of 2 feet was expedient, or that any gauge at all approaching it was correct, yet, he considered, that the same gauge could not be suited to every description of traffic. The gauge adapted to the costermonger's cart would not answer for Pickford's vans, and the gauge of ocean steamers would not suit the penny boats on the Thames. He thought the cost of constructing a line was very little influenced by the width of the gauge; but was rather influenced by the width of the carriages. It was desirable that a uniform gauge should prevail all over the country, and good reasons ought to be shown for deviating from the established gauge. At the same time he hardly conceived it was a gauge suited to all circumstances, and cases might arise in which the local traffic might be better provided for by a narrower gauge. What led him to think so was the result given by the Author, who had shown that an engine weighing only 7½ tons could take a load of 50 tons up a gradient of 1 in 60. On the Metropolitan lines, engines of 40 tons were often employed for less loads; but the exigencies of a metropolitan traffic required frequent and light trains, with power to get rapidly into speed, and thus resembled the case of the penny boats on the Thames. He agreed with Mr. Gregory, that there was little economy in the construction of these exceptional gauges, and he thought what was done upon the 2-feet gauge might possibly be done upon the gauge of 4 feet 8½ inches. Still the fact of what had been performed by the locomotives on the Festiniog line was worthy of attention, and he thought the Institution was much indebted to the Author for having brought the subject forward.

Sir Cusack Roney had seen the gauges of Canada and the United States, and had travelled upon Continental lines in various parts of Europe. He had also had the opportunity of seeing the working of many branch lines, and he was thoroughly convinced of the desirability of a uniformity of gauge in all cases, between the branches and the main lines. He considered that the gauge adopted in this country was the correct and really practicable one. In most parts of Europe he had met with nothing but the narrow gauge: with one exception—where the line was worked by horse-power.

Mr. Robert Mallet begged to offer one or two observations in explanation. He had not intended to say, that in choosing a gauge the choice depended upon the purely physical considerations he had brought forward, but, on the contrary, that the choice of gauge must depend upon prudential considerations, and, amongst other things, primarily upon the question of traffic. To put an obvious example: If the whole traffic were to be of cubes of granite, or other stone, each of 20 tons weight, a railway of even more than 7 feet gauge might not be sufficient. Thus at the harbour works at Holyhead the contractor's gauge was 9 feet, or 10 feet, being employed for the transport of blocks of 15 tons. But for certain conditions and amounts of traffic, a narrower gauge than 4 feet $8\frac{1}{2}$ inches would not only be sufficient, but would be found the most economical and advantageous. What he had stated with reference to gauge was, that it was a general physical fact, that both the first cost of the works, and of the rolling stock of any similar railways, and also the working expenses for the haulage of any total of traffic, must increase with the width of the gauge, and as a high function of it, and that this function would probably be very nearly in the ratio of the cube of the gauges. English railways with a gauge of 7 feet, and those with a gauge of 4 feet $8\frac{1}{2}$ inches, could not be compared, in those respects, not being similar either in way, or in rolling stock; thus, as respected the wheels and axles, those of the Great Western were rather lighter, being obviously weaker than those used on the narrow gauge, and having only the same width of tread. In the case of the passenger carriages, as a whole, he found the bodies were nearly of the same breadth on the narrow gauge as on the broad, on the former the overhang was greater. It was thus impossible to establish any ratio whatever between the width of gauge and rolling stock, where there was no similarity of construction on the two different gauges.

With respect to the remark that if the width of the gauge were 'nil' the cost of working would be also 'nil,' it should be remembered, that on such an assumption the traffic also became 'nil' at the same moment; so that while the mathematical deduction might be true, it did not in the least touch the question of the relative economy of the narrow and the wide gauges.

Mr. George England said, he did not for a moment apprehend, that the narrow gauge of the Festiniog railway was regarded as having been brought forward as a pattern for universal adoption. That line had been made fifteen years, and it was not originally contemplated that it would ever be worked by locomotives. During the time that the traction was performed by horses, the owners were satisfied, both with the mode of traffic and the dividend the line yielded; and it was only when another company wished to take a wider gauge into the district, that the working of so narrow a gauge by locomotive power was determined upon. It was done solely in self-defence; and he was applied to, to carry out the object of drawing a load of 25 tons up an incline of 1 in 60

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at the rate of six miles per hour. The first engine that was started took a load of 50 tons up the line at the rate of 12 miles per hour. That was simply the statement that the Author had brought before the Institution. The line was 14 miles long in the incline: the wagons were taken into the slate-quarries, and the locomotive was only adopted in order to suit local circumstances.

In pursuance of the notice on the card of the Meetings, it was proposed, and resolved unanimously:—

"That in order to insure a fuller attendance of Members than could be obtained on Easter Tuesday, the Meeting be adjourned until Tuesday evening, the 25th of April."