

other expenses of the company. When we consider the large sums necessarily required for repairs of engines and rolling stock generally, repairs of buildings and fences, management, salaries, office and station expenses, fuel, oil and waste, legal expenses, damages, taxes, &c., it appears not a little astonishing that the cost of keeping the iron rails in a proper state of safety and usefulness should bear such a large proportion to the gross expenditure on those various services.

That the maintenance of the permanent way, forming such a heavy charge against the revenue of a company, indicates some defect in its construction, is quite within the bounds of possibility; it at least leaves an opening for enquiry, if not for some improvement, in that portion of a railway which is permanent only in name.

For some years back an endless variety of plans have been invented to render more perfect this essential part of railways. Many of them have been tried with various degrees of success, while not a few have, by common consent, remained the useless property of their originators. The plan now submitted may form an addition to the long list of those last mentioned, although I am not without hopes that on a consideration of the advantages which it appears to possess, it may justify the cost of a practical test, and perhaps be a means not only of enhancing the comfort and safety of railway travellers, but also of assisting in some degree to make railways pay, by reducing the present heavy cost of maintenance.

It is of vast importance to ascertain the weak and defective points of existing systems of "permanent way," since, by so doing, we know where remedies should be applied. Experience shows that the ordinary rail track is defective in one essential principle, inasmuch as its continuity of strength is broken at the ends of every rail bar. The joints being deficient in the requisite strength, they are affected more than other parts of the rail bars by the weight and percussive shocks of passing loads, the ballast underneath yields from the unequal pressure, the chairs and spikes at these points constantly get broken and displaced, and as a consequence the whole track, without frequent inspection and repairs, rapidly becomes deranged. The climate of this country too, I am constrained to believe, tells much more severely on the permanent way, as at present constructed, than it does in England. The frost enters the ground to a great depth, and results at certain seasons in softening the substratum. Thereupon a depression of the ballast under the weight of train, and a vertical work-