

another, it is evident that on the former the gradients and curves, and such elements of resistance, must be more severe than on the latter; and that therefore the latter line is the better able to do its work, and can, other things being equal, do it more cheaply. Of course other circumstances may cause an unusual consumption of fuel, such as severity of climate, inducing large evaporation and loss of heat; or badly-designed engines, resulting in waste of fuel. But even these are matters that can be controlled, because the first may be obviated by having the engine more thoroughly protected from the weather, and the second by improvements in the type of engine. With similar engines acting under not very dissimilar climatic influences, it remains that the consumption of fuel per unit of work may be taken as a certain index to the character of the railway.

In preparing the Table which accompanies this Paper, considerable difficulty has been experienced in arriving at the requisite data. The published annual reports seldom give the information in the direct manner in which it is required; but all the figures made use of have been drawn either from the published reports, or from information obtained directly from the railway officials.

On the Canada Southern Railway, where the consumption of fuel is lower than on any of the other lines, the gradients and curvature are very light. The main line of this railway extends through the southern part of the province of Ontario in Canada, from Fort Erie on the Niagara River, where the International Bridge gives access to the State of New York, and opposite to the city of Buffalo, to Amherstburg on the Detroit river, separating Ontario from the State of Michigan. The Detroit river is crossed by ferry-boats, on which the carriages are taken over to Grosse Isle; from whence they run into Toledo (where connection is made with the Wabash railway system), or into Detroit (where connection is made with the Michigan Central system), over the Toledo, Canada Southern and Detroit Railway. The distance from Fort Erie to Amherstburg is 229 miles, and throughout there is no gradient steeper than 15 feet to the mile (1 in 352), and the alignment is remarkably free from curves. On the western portion of the line, the distance from St. Clair junction to Amherstburg, 107 miles, is made up of two straight lengths of 53 and 54 miles, joined by a light curve. The same gradient is maintained on the Toledo, Canada Southern and Detroit Railway, and on the St. Clair branch of the main line. The only parts of the system on which steep gradients exist are the Erie and Niagara, and Michigan Midland lines; but on these the traffic is extremely small, and they aggro-