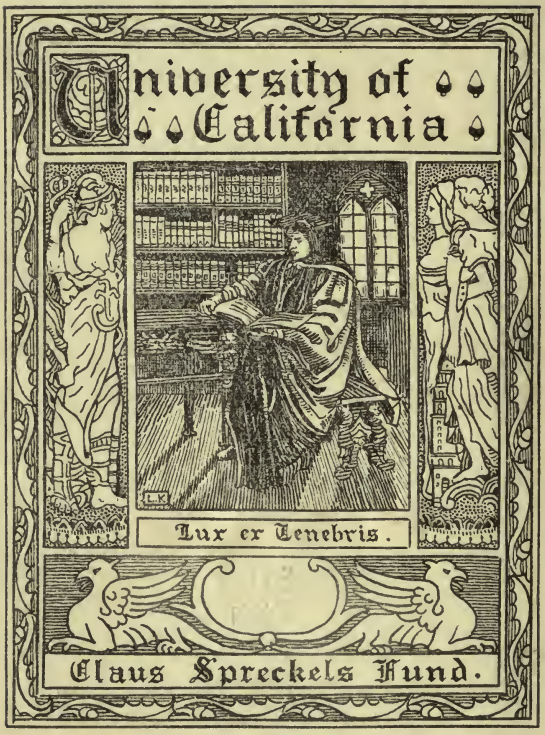
BRITISH RAILWAYS

HUGH MUNRO ROSS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BRITISH RAILWAYS

THEIR ORGANISATION AND MANAGEMENT

BY

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PREFACE

THIS little book aims at providing for the general, non-technical reader an account of the railways of the country, which may enable him to understand something of the conditions in which they work, the difficulties they encounter, and the problems they have to solve. It is not to be regarded as a text-book of railway management, and considerations of space have rendered it necessary altogether to omit some topics that might have been treated and to dismiss others with only a brief reference. Nor is it a statistical manual, the figures contained in its pages having been introduced not for their own sake, but simply for purposes of illustration and comparison.

H. M. R.

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BRITISH RAILWAYS:

THEIR ORGANISATION AND MANAGEMENT.

CHAPTER I

THE GROWTH OF THE SYSTEMS

Construction of Railways—Promotion in Parliament—Board of Trade Inspection—Amalgamations—The Principal Systems—Mileage of Chief Lines.

As a general rule, no railway can be constructed in the United Kingdom except with the sanction and authority of Imperial Parliament. It is true that any landowner is free to build a line on his own ground, and to operate it so long as he does not cause a nuisance or in any way interfere with the rights of his neighbours. Instances of such construction may be found in the line to the summit of Snowdon, and the private railway through the grounds of Eaton Hall to Balderton on the Great Western. But as soon as a railway constructor passes the boundaries of his own domain and has to enter the territories of other people, to cross public roads, to bridge rivers, and to do the various

other things without which a commercial railway is an impossibility, an Act of Parliament becomes indispensable. An apparent exception is furnished by so-called "light railways." By the Light Railways Act of 1896, the inquiry into the desirability of the proposed line, which is conducted by Parliament itself when an ordinary railway is concerned, is held locally (thereby avoiding the expense of bringing the witnesses up to Westminster) by three Commissioners, on whose "Order," confirmed (and perhaps modified) by the Board of Trade, the line may be constructed. But, as a matter of fact, this is not an exception. The Board must rather be looked upon as merely exercising powers delegated to it by Parliament for a specific purpose—delegated, moreover, to a strictly limited extent, for schemes which affect many important interests or involve some new principle or policy have still to be submitted to the consideration of Parliament itself. The object of this delegation of powers was to simplify procedure, and reduce the costs of promotion, which form an appreciable item in the capital expenditure of a new railway, though not so large a one now as it sometimes was formerly.

It may be taken, therefore, that before any important railway can be made the authorisation of Parliament must be obtained. The Standing Orders of the two Houses require that applications for new lines be filed in prescribed form, that written notices be served on landowners affected, and that drafts of the Bill, together with engineering details of the proposed works and a 5 per cent. deposit on their estimated cost, be lodged at specified times; and if the

regulations are not exactly followed the Bill will probably be killed in its infancy, and never reach the stage of being considered by either House. To guard against this mishap, the promoters employ the services of a parliamentary agent, part of whose business it is to pilot it through the dangers of parliamentary procedure. Having escaped shipwreck in its early stages, the Bill is read for a first and a second time in either the Upper or the Lower House, according as it originated in one or the other, and then comes before a Select Committee of that House. There the promoters marshal their evidence to prove that the proposed line will serve a useful purpose, that it is desired by the inhabitants of the localities through which it is to pass, and that it is likely to command sufficient traffic to pay. There also those who are opposed to it—the landowners who think it will spoil the amenities of their lands, the local authorities which deem their districts will be injured by its construction or are dissatisfied with the accommodation it proposes, the competing railway companies which fear it will abstract some of their traffic, all combine in attempting to show that, for some reason or other—because it is not wanted, or because the financial position of its promoters is not satisfactory, or because it cannot be a commercial success, or because the plans or estimates of its engineers are defective—its construction should not be sanctioned. Should the opposers be able to bring forward sufficiently strong objections to the scheme, or should the Committee form the opinion that it is unsound financially or otherwise undesirable, the Bill is thrown out and

becomes dead for that Session at least. If, on the other hand, it wins the approval of the Committee, it is sent, with or without modifications, to the House for third reading, after which it goes to the other House. There it is again read a first and second time, again considered by a Select Committee, and, if fortunate, again read a third time. Finally, it receives the Royal Assent and becomes an Act.

Before exercising their powers, the promoters must raise their capital. That done, they acquire the land necessary for their undertaking. With some of the landowners they will be able to agree as to the price to be paid, but others will make exorbitant demands which it is impossible to entertain. In dealing with these they find the benefit of having parliamentary authority behind them, for on serving "notices to treat" they can compel the proprietors to sell at what are adjudged to be fair values by an independent arbitrating tribunal which has heard all the circumstances as presented by both sides. The purchase having been settled, they take possession of the land, and the engineers come upon the scene, though sometimes a further delay is caused by the fact that a railway appropriating ground inhabited by the working classes is often required to provide suitable dwellings within a reasonable distance, to which the displaced population is supposed to migrate. The next few years are occupied in the actual work of construction,—in making cuttings and embankments, building bridges and viaducts, laying down the permanent way, erecting the station buildings, fitting up the signals and telegraphic apparatus, etc. A definite

period (five years) is specified in the Act for the completion of the work, under penalty of fine, and if this time proves insufficient the railway company has to apply for a further Act extending it. As soon as the rails are in place, goods and mineral trains may be run, and that is almost invariably done in order to consolidate the road-bed and embankments; but, before a passenger train service may be begun, the line must be inspected by one of the inspecting officers of the Board of Trade, and certified by him to be properly equipped for passenger traffic. He examines everything connected with the line with considerable minuteness, and sees that in such matters as the strength of bridges, the placing of points and signals, interlocking, the arrangements at stations, etc., the requirements of the Board are fully complied with. Not only new lines, but also additions to existing lines, have to be inspected in this way; and if the inspector withholds his certificate on the ground that the state of the line or equipment is such as to be dangerous to the public if passenger traffic were run, the Board may, by the Regulation of Railways Act of 1842, refuse to allow the opening of the new portion for any period up to one month. If its officers are not then satisfied, it may do the same for another month, and so on indefinitely, the railway which carries passengers on a piece of line in respect of which the Board has not issued its certificate being liable to a fine of £20 for each day during which the offence is continued.

Although anyone who can pay the deposit required by Parliament may promote a new line, in

very many cases the applications are made on behalf of existing railway companies, which usually have one of two objects in view—either to extend their lines into territory which promises to yield a remunerative traffic, or to occupy a piece of country with a line which, though it may not pay very well of itself, will yet serve an important strategical purpose in preventing a rival from gaining a foothold in a region where it may be able to do damage. In fact, the railway map of England is now so full that it is almost impossible for any one company to extend its lines without affecting the interests of others, which therefore have something to say in Committee regarding its proposals. Occasionally it will succeed in getting exactly what it wants, but often it will be obliged to submit to modifications and restrictions imposed at the instance of its rivals, or to grant them concessions, such as running powers over the new line or some portion of its existing system. For instance, when in 1893 the Manchester, Sheffield, and Lincolnshire Railway (now the Great Central) obtained powers for its extension to London, it naturally had to face the opposition of the Great Northern, which was then carrying to the south a large proportion of the traffic collected by its cross-country system between Chester and Grimsby, and as a price for the withdrawal of this opposition it had to grant its former partner full running powers over all its lines north of Nottingham and west of Retford. Sometimes, again, two or more companies unite to construct a line jointly: thus, in 1902, five of the big companies, to thwart an independent scheme, combined in obtaining powers for a

short piece of railway, only 16 miles long, designed to open out a new coalfield in Yorkshire, south of Doncaster.

Of lines promoted independently, that is, not on behalf of existing systems, the fate, sooner or later, is usually to fall into the hands of established companies; it may even be suspected, and certainly it has frequently been the case in America, that in some instances this is the chief, though unavowed, end their promoters have in view. It is, indeed, by the gradual absorption of smaller independent undertakings that the big trunk systems of Great Britain, and also of the United States, have been formed. After the Liverpool and Manchester Railway, which was opened for traffic in 1830, had proved itself a success far beyond the expectations of the body of Liverpool merchants who planned it, there was a great outburst of railway enterprise, culminating in the "mania" of 1843–1845, and the result was the construction of numbers of lines all over the country. So long as these remained isolated units they had of necessity to be worked separately, but, when they began to come into physical connection with each other, the advantage of centralising administration and of working several together as one whole soon became apparent, apart from the fact that many of them were not strong enough to stand alone. Union was brought about in various ways. Sometimes one company invited another to operate its lines on the terms of receiving a certain percentage of the receipts; sometimes one line acquired from Parliament the right to run trains over another; sometimes one company leased another's

undertaking at a fixed rental and for a long period, often 999 years; and sometimes one company bought up another's property and rights in their entirety. All the important railway companies of to-day could afford instances of lines added to their systems by each of these methods, and often a piece of line was held first in one of these ways and then in another.

On the whole, however, the last-named method is the one by which the trunk lines have consolidated their position. The London and North-Western Railway, for instance, is now absolute owner of by far the larger number of the once independent lines by the absorption of which its system has been built up. It began as the London and Birmingham Railway, which was opened for traffic in 1838. Eight years later this concern obtained powers to amalgamate with the Manchester and Birmingham and the Grand Junction, which by an earlier Act of the same year was already merged in the Liverpool and Manchester, and it celebrated this extension of its sphere of operations by changing its name to the London and North-Western. Since that time it has absorbed scores of other lines, including the Chester and Holyhead and the Lancaster and Carlisle, which gave it access to Ireland and Scotland respectively, and the capitals of all these are now merged in its consolidated stock. But it also works its own trains over many miles of line of which it is either not full proprietor or has no proprietary rights whatever. Thus in many cases it possesses running powers over railways owned by other companies; sometimes it divides the ownership with another company—*e.g.*, it

is joint owner with the Great Western of the Shrewsbury and Hereford line; sometimes it has secured control by owning a large proportion of the capital, as it does in the case of the North London, the Shropshire Union, and the Dundalk, Newry, and Greenore railways; sometimes, as with the Birmingham and Harborne line, it has undertaken to work the traffic for a fixed percentage (in this instance 50 per cent.) of the gross receipts.

The other larger railways of this country have a history similar in character to that of the North-Western, though the work of consolidation has not always advanced so far. Some railways do not enjoy complete ownership or control, even over their main lines. For example, the main line of the London, Chatham, and Dover Railway, for a distance of over two miles between Shortlands and Bickley, belongs to an independent company, the Mid-Kent Railway Company, by which it was leased to the Chatham Company in 1863 for 999 years; while the Great Central's trains, in order to reach London, have to run over some 42 miles of railway owned and controlled by the Metropolitan Railway, though they will have an alternative route on the completion of the line, now being built by the Great Western and Great Central jointly, from Grendon Underwood to Northolt.

The following are brief geographical particulars of the principal railway systems which have been formed in Great Britain and Ireland by the operation of the processes just described:—

The *Great Western's* main line runs from London

(Paddington) through Bristol, Exeter, and Plymouth to Penzance, a distance of 326 miles. At Didcot a line branches northwards through Oxford, Birmingham, and Shrewsbury to Chester and Birkenhead, while another diverging near Bristol leads through the Severn Tunnel to Cardiff, Swansea, and New Milford.

The *London and South-Western's* main line starts from Waterloo Station, London, and, after throwing off at Woking a branch for Guildford and Portsmouth, divides at Basingstoke into two parts, one of which proceeds westwards through Salisbury to Exeter, Plymouth, and North Cornwall, while the other trends to the south-west to Southampton, Bournemouth, and Weymouth.

The *London, Brighton, and South Coast*, with London termini at London Bridge and Victoria, has one main line running through Horsham and Chichester to Portsmouth, and another through Three Bridges to Brighton, Hastings, and Eastbourne, with a route also to Tunbridge Wells.

The *South-Eastern and Chatham* occupies the territory immediately to the east of the London, Brighton, and South Coast, and, with a monopoly of the county of Kent, serves Hastings, Folkestone, Dover, Ramsgate, and Margate. It has five termini in London—Cannon Street, Charing Cross, Holborn Viaduct, St. Paul's, and Victoria.

The *Great Eastern* possesses a large network of lines, many single, in the counties of Norfolk, Suffolk, and Essex, its main lines running through Cambridge to Ely and Peterborough, and through Colchester and Ipswich to Yarmouth, Norwich, and Cromer. From

Liverpool Street, its London terminus, it carries on a huge suburban traffic, and also conveys passengers to Doncaster and York by the aid of a line owned jointly with the Great Northern.

The *Great Northern's* main line leaves London from King's Cross Station, and was once described as ending in a field some miles north of Doncaster. Its trains, however, run through to York on the North Eastern's metals from Shaftholme Junction, and in addition it serves such places as Leeds, Nottingham, Sheffield, Manchester, and Great Grimsby. It also forms one section of the East Coast route to Scotland.

The *Midland's* main lines roughly form a cross with its centre near Derby. One arm goes to Manchester and Liverpool, another reaches to Bristol through Birmingham and Gloucester, a third passes north through Leeds to Carlisle, and a fourth south to Nottingham, Leicester, and London (St. Pancras). In July 1903 the company absorbed the Belfast and Northern Counties system, in the north of Ireland.

The *London and North-Western's* main line stretches from London (Euston to Carlisle), through Rugby, Crewe, and Preston, and forms the English portion of the West Coast route to Scotland. At Rugby a branch leaves on one side for Birmingham, rejoining the main line at Stafford, and on the other for Peterborough; while at Crewe, the real centre of the system, lines diverge on the east for Manchester and Leeds, on the south for Hereford and South Wales, and on the west for Chester, Holyhead, and North Wales, and for Liverpool.

The *Great Central's* system is in the shape of a T. Starting from Marylebone Station, London, its main line passes through Leicester and Nottingham, and then meets the east and west line that runs from Grimsby on the one side, through Sheffield and Penistone to Manchester and Liverpool on the other.

The *Lancashire and Yorkshire* has its headquarters at Manchester, and serves a thickly populated area extending from Liverpool, Southport, Blackpool, and Fleetwood on the west, to Bradford, Wakefield, Goole, etc. on the east.

The *North-Eastern* runs north from Leeds and York through Newcastle-on-Tyne to Berwick, serving a rich industrial district in which it has scarcely any competition to meet. Its main line is abundantly fed by numerous branches on both sides, including on the west those from Newcastle to Carlisle, from Darlington to Penrith and Tebay on the London and North-Western, and from Northallerton to Hawes on the Midland. It forms the middle link of the East Coast route to Scotland.

Of the Scotch railways, the *North British* has two lines from Edinburgh to the south—one along the coast to Berwick, where it makes an end-on junction with the North-Eastern; and the other to Carlisle through Melrose, forming the "Waverley" route, used by the Midland Company's trains to Edinburgh and the North. From Edinburgh one line crosses the Forth Bridge, and runs along the coast to Aberdeen, for part of the way over the Caledonian's lines; another passes through Glasgow, and makes its way through the most magnificent mountain scenery to

Fort-William and Mallaig, in the West Highlands. The *Caledonian*, starting from Carlisle, keeps a more central course, and reaches Aberdeen by way of Perth. On the west it throws off lines to Glasgow and Gourock and to Oban, and on the east to Edinburgh. At Stanley Junction, a few miles north of Perth, the *Highland* railway diverges from it, and, traversing the Grampians, runs past Inverness to Thurso and Wick, with a branch at Dingwall to Kyle of Lochalsh on the west coast. Of the *Glasgow and South-Western*, one line runs from Glasgow through Dumfries to Carlisle, the trains using the Caledonian's rails on the last portion of the way from Gretna into Carlisle, while the other skirts the west coast and reaches Stranraer *viâ* Ayr.

In Ireland, the main line of the *Great Southern and Western* runs south-west from Dublin through Thurles and Mallow to Cork and Queenstown. The company also possesses east and west lines from Waterford through Mallow to Killarney and Valentia, and through Tipperary to Limerick and Ennis, with a northerly extension to Athenry and Sligo. An amalgamation with the Waterford, Limerick, and Western Company, carried out in 1901 in connection with the Fishguard and Rosslare scheme, gave it control of most of the south and south-west portions of the island. The *Midland Great Western* runs due west from Dublin (Broadstone) through Mullingar and Athlone to Athenry and Galway, with branches from Mullingar north to Sligo, and from Athlone north-west to Ballina and Westport. The *Great Northern's* main line extends from Dublin (Amiens Street)

through Drogheda and Dundalk to Belfast, branches from Portadown and Dundalk enabling it to serve Clones, Enniskillen, and Londonderry.

Arranged according to their geographical mileage, the above eighteen railways stand in the following order, the figures being those given in the Board of Trade Returns for 1901. The length of line of each company in 1891 is added for comparison:—

	1901.	1891.
Great Western	2656 miles.	2481 miles.
London and North-Western	1937 ,,	1890 ,,
North-Eastern	1654 ,,	1612 ,,
Midland	1441 ,,	1382 ,,
North British	1301 ,,	1096 ,,
Great Eastern	1109 ,,	1104 ,,
Great Southern and Western (Ireland)	1074 ,,	567 ,,
Caledonian	956 ,,	875 ,,
London and South-Western	911 ,,	838 ,,
Great Northern	832 ,,	829 ,,
South-Eastern and Chatham	618 ,,	578 ,,
Lancashire and Yorkshire	556 ,,	523 ,,
Midland Great Western (Ireland)	538 ,,	441 ,,
Great Northern (Ireland)	533 ,,	522 ,,
Great Central	494 ,,	324 ,,
Highland	485 ,,	418 ,,
London, Brighton, and South Coast	454 ,,	439 ,,
Glasgow and South-Western	400 ,,	347 ,,
United Kingdom	22,079 ,,	20,191 ,,
England and Wales	15,309 ,,	14,156 ,,
Scotland	3,562 ,,	3,172 ,,
Ireland	3,208 ,,	2,863 ,,

These figures, however, do not afford any very exact indication of the length of track each company has to maintain. In the first place, they include running lines only, and take no account of sidings; in

the second, they do not distinguish between sections of railway that are laid with one, two, three, or more lines of rails. No information can be recovered from the Board of Trade Returns as to sidings, although they involve railway companies in a large outlay of capital, and a not inconsiderable expenditure for maintenance. As an instance of the difference they would make in the figures, it may be mentioned that the London and North-Western in 1902, returned as working 1937 geographical miles of line, possessed in addition about 1400 miles of sidings. With regard to the second point, the Returns do dissect the running lines into miles of single, double, triple, and quadruple or more tracks, and so render it possible to express the length of each company's system in miles of single track. When this is done the railways mentioned above take the following order, though some slight injustice is done to companies which, like the London and South-Western and the Great Eastern, possess in certain places more than four lines of running rails, since these have been treated in such cases as having four only. The importance of such information in regard to maintenance is obvious, when the Great Western, with 1284 miles of single line, 1275 of double, and 83 of quadruple or more, is compared with, say, the North-Western, which had 1295 miles of double line, 202 of quadruple, but only 410 of single. Again, judged by geographical mileage, the Great Eastern appears to be a considerably larger system than the Great Northern; yet there was in 1901 a difference of only 20 miles in the length of single track maintained by the two.

	Miles of Single Track. 1901.	1891.
Great Western	4209	3700
London and North-Western	3898	3727
Midland	2955	2664
North-Eastern	2904	2688
North British	1827	1579
Great Eastern	1807	1719
Great Northern	1787	1576
London and South-Western	1610	1318
Caledonian	1501	1368
Great Southern and Western (Ireland)	1314	775
South-Eastern and Chatham	1211	1127
Lancashire and Yorkshire	1090	1024
Great Central	999	662
London, Brighton, and South Coast	842	769
Glasgow and South-Western	699	614
Midland Great Western (Ireland)	699	601
Great Northern (Ireland)	676	661
Highland	514	428
United Kingdom	36,033	32,237
England and Wales	27,165	24,301
Scotland	5,031	4,464
Ireland	3,837	3,472

The Board of Trade Returns for the United Kingdom do not include the railways in Jersey and the Isle of Man: in the former there are about 14 miles of single line, in the latter about 45 miles, exclusive of an electric tramway up Snaefell.

CHAPTER II

COMPETITION, COMBINATION, AND CO-OPERATION

Competition does exist—Alliances between different Companies—Pools and Agreements—Conferences—The Railway Clearing House.

THE principle, adopted in France, of allotting to each railway system a definite sphere of operation, from which other lines are more or less completely excluded, has never been followed in British legislation. Our railway system has rather, in the usual British fashion, been allowed to develop untrammelled by any comprehensive plan, and, as one result, few of the larger companies have a monopoly over any considerable area free from the incursions of rival lines. The North-Eastern attains most nearly to independent isolation of this kind, and the North-Western in North Wales, the combined South-Eastern and Chatham in Kent, the Great Eastern in the eastern counties, to mention no others, enjoy it to a more limited extent. But the majority of important districts are served by two or more rival companies, each anxious to secure as large a share of the traffic as possible; and therefore it may be said that, on the whole, the railway services of the country are carried on under competitive con-

ditions. Superficial observers, indeed, noticing that, as a rule, it costs as much to travel or send goods by the shortest route between two places as it does by the longest, have sometimes hastily concluded that real competition does not exist. That, however, is a mistake. There is, it is true, little or no competition in regard to the charges levied for conveying passengers or merchandise, although rate-wars are by no means unknown in British railway history; and that the case stands thus is a very good thing for the industry of the country, since stability of rates is more important than any casual advantage a trader can gain from excessively cheap transportation for a brief and uncertain period during which the railways that serve him are engaged in a campaign of rate-cutting. The competition which does exist is in regard to the quality of the services rendered—the frequency of trains, the speed at which they run, the comfort of the accommodation offered to passengers, and the punctuality and dispatch with which goods are collected and delivered to their destinations. In these respects every railway company is perpetually striving to outdo its rivals; and that this competition has been effective, and has been of immense benefit to the public, whatever may have been its results for railway shareholders, cannot be doubted by anyone who considers the advances and improvements that have been made in British railway travelling and transport during the last twenty or thirty years.

But the very circumstances that constitute this competition also invite combination; not, indeed, between the lines running to a given place, but between each

of those lines and others able to afford advantageous connections for through carriage to important seaports and manufacturing centres. Such combinations do not necessarily mean the formation of units under the same administrative and financial control, though that is sometimes the final outcome, but are rather offensive and defensive alliances for mutual benefit between independent bodies which may even be keen trade rivals in other districts.

The most conspicuous combinations of this sort are the three which divide the traffic between England and Scotland, and form the main trunk routes between the south and the north. Of these, the West Coast route is a combination of the London and North-Western with the Caledonian, the East Coast route of the Great Northern with the North-Eastern and North British, and the third or Midland route of the Midland with the Glasgow and South-Western, so far as Glasgow traffic is concerned, and with the North British for Edinburgh and places in the north. What happens in consequence of these combinations is that a passenger buying a ticket to, say, Glasgow at Euston or other North-Western station will find that it takes him to the Caledonian Station at his destination; a ticket purchased on Midland territory, at St. Pancras, for example, similarly taking him to St. Enoch, the station of the Glasgow and South-Western Company. If he is anxious to travel by the Midland, say, from London to Carlisle, and thence by the Caledonian onwards, he may get a ticket enabling him to do so by explicitly asking for one; but he will suffer under the disadvantage of not obtaining a through carriage, and

probably of finding that at Carlisle the trains are not timed to connect. In the same way, goods consigned to England from a Caledonian station would, in the absence of express instructions to the contrary, be conveyed as far as possible over the North-Western's lines, even though the Midland should happen to have a shorter and quicker route.

Another form of combination sometimes resorted to is known as pooling, or "Percentage Division of Traffic." Here two or more companies having competitive routes between two places or districts agree to put the receipts into a common fund, which is divided between them in such proportions as may be agreed on, each first reserving from the monies it collects for conveying traffic over its own line a fixed percentage, say 25 per cent. or 30 per cent., to cover the bare expenses of the trains it works. Pools are regarded with some suspicion by a large section of the public, who fear that they involve the disappearance of wholesome competition, and on that account the companies which enter into them are not always disposed to proclaim the fact to the world at large. On the other hand, many people see in them a promising means of securing greater economy in railway working, and therefore advocate their wide adoption in order to get rid of the "wasteful competition" so often lamented by railway administrators. The conduct of the traffic between London and Manchester is frequently referred to as an awful example in this connection. Between these two cities there is more or less effective competition for passenger traffic by four routes and for goods by six. This condition of affairs,

it is argued, involves the waste of large sums of money. More passenger trains, it is said, are run by the various lines than are needed to accommodate the number of travellers between the two places, and therefore they are not so well filled as they ought to be in order to fulfil the conditions of economical working. Similarly, the scramble for merchandise traffic is alleged to cost the companies concerned millions of pounds annually in canvassing, collection, delivery, etc., while the receipts are not sufficient to yield an adequate return on the poorly loaded trains they are obliged to run.

There is considerable force in contentions of this sort; but, at the same time, it may be questioned whether the conclusion of a pooling arrangement, in this particular case or in others, would be so effective in reducing train-mileage as is sometimes supposed by advocates of such a course. If the trains running between London and Manchester carried nothing but through traffic between these two places, a reduction in their number could doubtless be effected; but it must be remembered that they also serve various intermediate places which require communication with both Manchester and London; and the fact that these would have to be provided for, pool or no pool, would tend to maintain the number of train-miles run, even though the number of nominally through trains were reduced.

In some circumstances, too, the arrangement of a pool, if not impossible, at least presents great difficulties. The percentage of the pooled receipts to be distributed to each of the participating companies

must be based on the amount of traffic each was carrying before the establishment of the pool. If the lines concerned have reached a stable condition which warrants the supposition that their relative traffics will not vary to any great extent over a fair number of years, then to settle the terms of a pool is a moderately simple matter. But the case is different when a disturbing factor is introduced by such a circumstance as that one of the lines to be included is new, and has not properly shown what capabilities it possesses for attracting traffic. In discussing what proportion of the receipts it shall receive, a young line, of course, lays stress on its potentialities for development in the future, while its older rivals fix their attention on its present performances. If an agreement is arrived at, it must provide for a revision after a certain interval—perhaps five years. Then the new-comer, in the hope of getting better terms at the expiry of that period, will very probably make the most strenuous efforts to develop its business; and in the end the other parties to the pool, obliged in self-defence to increase their expenditure to keep pace with it, may find that they are no better off, perhaps worse, than when the traffic was openly conducted competitively. The result will naturally be the collapse of the arrangement. This is pretty much what happened to a pool the terms of which were arranged by Mr. Gladstone about the middle of last century, to include the traffic between London and various towns in the north. In that instance the Great Northern, then recently opened for traffic, was the new line that provided the disturbing factor; and at the present

time, were a pool arranged for the traffic between London and Yorkshire and London and Lancashire, the Great Central, which only gained an independent access to London in 1899, might not improbably exert a similar influence.

But granting the possibility of reducing the train service between two points, without giving the public fair cause to grumble because of inadequate service, it may be suggested that a pool is not the only conceivable way in which the reduction may be effected. There is a tendency among the chairmen of railways engaged in strongly competitive traffic—especially among those whose lines have the fewest advantages in the struggle—to speak at half-yearly meetings as if the running of superfluous trains were a sad necessity inevitably imposed by the operations of their rivals. But is that really the case? Because railway A, which has the quickest and best patronised route between M and N, finds it can get good paying loads for six express trains a day, is that a valid reason why railway B, with a longer and less popular route, should persist in running an equal, or even greater, number of trains between the same places at practically the same times as those of A, although it can get little traffic to carry in them? Or because railway C puts on a new train reducing the time between P and Q from 4 to 3¾ hours, is railway D justified in replying with another new train that cannot perform the journey in less than 4¼ hours? It would not be difficult to point to instances in which British companies appear to have answered these questions in the affirmative, to judge by their deeds; but the

answer can scarcely be defended on ordinary business principles. While the British public has been educated up, largely by the efforts of the companies themselves, to expect a standard of service higher than is given in any other country, and while there are undoubtedly cases in which a railway has practically no choice but to run unremunerative trains, in general the proper course must be, if possible, to dispense with trains that are known not to be running at a profit.

In this respect, a certain timidity and lack of initiative is discernible. If what is said at half-yearly meetings is to be taken seriously, and is not intended merely to secure the silence of inconvenient critics, there is more than one railway chairman who would like to withdraw certain of his competitive trains the earnings of which are not satisfactory, and who has a shrewd suspicion that his rivals are also running trains which, for the same reason, they would be glad to treat in the same way; yet nothing is done, because each side is too shy to take the first step, and so the wasteful competition goes on, lamented but unchecked. On the other hand, it may be urged, in excuse of this hesitation, that a railway is naturally reluctant to do anything which may look like abandoning ground it has occupied, or which, being interpreted as a sign of weakness, may react injuriously to its interests in other directions. Further, when two companies, without pooling the traffic, have agreed to limit their train service to some competitive point, each is apt to have an uneasy feeling that the other is in some way getting more than its due share of the traffic. Such

suspicions are not always without justification, as the following story will show:—Two companies, which we may call A and B, arranged their service to a certain town so as to avoid the running of unnecessary trains. One morning a passenger to the place in question arrived at A's London terminus with a large amount of luggage, which considerably exceeded the free allowance. On being asked to pay the excess charge, he refused, and ordered his things to be put back on a cab and driven to B's station, the ways of which he doubtless knew. There, as was seen by one of A's servants who followed the cab, the luggage was put straight into the train without any demand for extra payment. Of course, when the manager of A brought this incident to the notice of B regret was expressed, and he was assured that the porter in failing to charge for the overweight of the luggage acted in contravention of his orders. But the fact remained, that B had secured one of A's passengers by what was virtually charging a lower rate than had been agreed upon between the two parties.

In addition to such working-unions as those referred to above, there are thousands of agreements and understandings between individual lines and groups of lines —some of doubtful public advantage, like "territorial agreements" whereby one company agrees to leave a given area entirely to another—but many intended simply to facilitate traffic, and thus to the public benefit. But over and above all formal agreements the railway companies of this country work together to an extent which is not realised by the average traveller. For example, at regularly appointed times there are

periodical meetings attended by representatives from the chief administrative departments of all the important railways, many of which are in vigorous competition and ready to snatch a passenger or a ton of goods from each other whenever occasion offers. Thus four times a year a "General Managers" conference, a "Superintendents of the Line" conference, and a "Goods Managers" conference meet to discuss, though by no means always to agree upon, matters connected with the particular branch of railway management in which the members of each are engaged. These conferences are known as "Clearing House Conferences" because they meet at the Railway Clearing House, though that institution has in fact nothing to do with them beyond providing them with accommodation.

Various other grades of railway officials likewise have their joint meetings, formal or informal. The engineers, for instance, in this way keep themselves in touch with what their professional brethren are doing on other lines; the carriage and wagon superintendents consider questions relating to rolling stock, such as the specifications to which wagons belonging to private owners must conform before they are permitted to run on any of the lines in this country; the officials in charge of the advertising departments sometimes settle such a comparatively trivial matter as in what newspapers the advertisements of a series of excursions shall or shall not appear. To provide for special cases, special conferences may be convened: for instance, the action of the Board of Trade in 1902, under the Railway Employment (Prevention of Accidents) Act of 1900, in calling on the companies to fit their wagons

with brakes which can be put on and taken off from either side indifferently, was followed by meeting after meeting of the wagon superintendents to examine the mechanical merits of various inventions intended to effect the desired result, and, if possible, to select a form or forms that would be accepted by all the companies as satisfactory.

Again, when a railway is asked to quote a rate for carrying some particular class of goods between two places which are also served by another company, it only does so in agreement with its competitor (unless indeed it is engaged in a rate war), and there are a number of conferences which meet for this purpose. Of these the most important are the "English and Scotch Traffic Rates Conference," the "English and Irish Traffic Rates Conference," the spheres of which are indicated by their names, and the "Normanton Conference," which deals with most other competitive rates in England. When through goods have been lost or damaged in transit, and the companies concerned cannot agree how the liability is to be distributed, the matter is sent for adjustment to the "Claims Arbitration Committee," a body composed of and elected by the goods managers of the different lines, which meets periodically in London, and whose decisions are final. A similar committee exists for the purposes of through passenger train traffic.

But the co-operation between British Railway Companies is perhaps most fully exhibited in the Railway Clearing House, an institution for which every user of the railways—whether as traveller or as consignor or consignee of goods—has much reason to be

thankful. It is by virtue of its existence that he can obtain through tickets between places on different companies' lines, that he can in many cases travel without changing at intermediate junctions in through carriages between those places, and that he can load his goods at the point of dispatch into a wagon in which they will remain undisturbed until they arrive at their final destination. It would be too much to say that without the Clearing House none of these advantages could be secured, since in America, where there is no Clearing House, through tickets are not unknown, and wagons travel far afield from the territories of the lines owning them; yet it is probably true that in no other way could these advantages be secured so extensively and with so little trouble to the parties concerned. The little piece of pasteboard which will of itself frank a man from, say, Penzance to Inverness, is an infinitely more convenient and less cumbrous contrivance than the book of coupons, or the strip of ticket with portions to be detached by each railway in turn, which would otherwise be inflicted on the passenger, unless indeed he were made to take a fresh ticket at every junction of different companies' lines.

The Railway Clearing House began its operations on the 2nd of January 1842, in a little house in Drummond Street, close to Euston Station—only a few hundred yards from the huge building it now occupies in Seymour Street. It appears that the idea of establishing such an institution for the railways—the Bankers' Clearing House of course had then been in existence for more than half a century—occurred to several persons almost simultaneously; but perhaps

the credit for the original suggestion should be given to Sir James Allport, whose name must always remain famous in railway history. As traffic manager of the Birmingham and Derby Railway, he had experience of the difficulties of dividing and adjusting the receipts for traffic interchanged between two or more companies, and it occurred to him that the work would be very much better done by an independent tribunal acting under the written instructions of the companies concerned. He mentioned his idea that a system similar to that of the London Bankers' Clearing House should be adopted to Robert Stephenson, then the engineer of the London and Birmingham, the Birmingham and Derby, and the North Midland—all railways which had through bookings with each other; and Stephenson, perceiving the merits of the suggestion, discussed it with the chairman of the London and Birmingham Company, Mr. G. C. Glyn, afterwards Lord Wolverton, with the result that the Clearing House was established under the management of Mr. Kenneth Morison.

At first it was a very small affair and only embraced nine companies—the London and Birmingham, the Midland Counties, the Birmingham and Derby, the North Midland, the Manchester and Leeds, the Leeds and Selby, the York and North Midland, the Hull and Selby, and the Great North of England. All these were narrow (standard 4 ft. 8½ in.) gauge lines, and not one of them now retains an independent existence. But its usefulness was soon recognised, and within a few years it numbered among its members practically all the narrow-gauge railways in Great Britain north

of the Thames, from Gloucester to Glasgow and from Edinburgh to London. In 1850 it was regularised by an Act of Parliament, which describes its functions as "to settle and adjust the receipts arising from railway traffic within, or partly within, the United Kingdom, and passing over more than one railway within the United Kingdom, booked or invoiced at throughout rates or fares." To-day its sphere of operations is so extended that there is not a railway of importance in the country that is not a party to it; and even the Government has to acknowledge its influence, for without its aid the Post Office would have found it difficult to establish the Parcels Post, and not less difficult to carry it on. There is also, it may be mentioned, an Irish Railway Clearing House, having its headquarters in Kildare Street, Dublin: this was established in 1848, and was incorporated by Act of Parliament in 1860. It counts many of the English and Scotch railways among its members.

The Clearing House, though an absolutely independent body, having the power to sue and the liability to be sued, is governed by delegates selected by the boards of the railways that belong to it, and its expenses are met by contributions from each line in proportion to the amount of business each passes through it. Any company may belong to it if admitted by the Committee of Delegates after formal application, may withdraw from it at a month's notice, or may be expelled if two-thirds of the delegates present, at a meeting specially convened for the purpose, vote in favour of such expulsion. The chairman of the delegates, at present Lord Claud Hamilton, is

elected annually, though he may be, and is, elected time after time, and the committee meets four times a year, a smaller committee of superintendence meeting every month. The staff employed at the offices in Seymour Street numbers well over two thousand, there being in addition some five hundred "number-takers" stationed all over the country, whose business it is to note the numbers, owners, destinations, etc., of vehicles passing through important junctions. The magnitude of the business conducted is fairly indicated by the fact that over twenty million settlements are effected annually, involving clearances which amount more nearly to thirty than to twenty million pounds.

The leading principles of the Clearing House system were in 1846 described by Mr. Kenneth Morison in the following words:—"First, that passengers shall be booked through at all principal stations, and conveyed to their destinations without change of carriage, that horses and cattle shall likewise be sent through without change of conveyance, and that goods shall in the same way be carried through without being either shifted or reassorted. Secondly, that the companies respectively shall pay a fixed rate per mile, for such carriages and wagons, not their own property, as they may use, and a further sum per day by way of fine or demurrage for detention, if kept beyond a prescribed length of time. And, lastly, that no direct settlement shall take place between the companies in respect of any traffic the accounts of which have passed through the Railway Clearing House." At the same time, Mr. Morison remarked that the Clearing arrangements might, by a simple and inexpensive plan, be applied to

the recovery and restoration of lost luggage, and he also looked forward to a time when the accounts of through goods traffic should also be passed through the Clearing House, those accounts being at that time settled directly between the railways and the established carriers,[1] in whose hands that traffic was. He had not long to wait, for in 1847 it assumed both functions, and in 1883 it undertook the further task of assigning to each company its share of the money paid to the railways by the Post Office for the carriage of parcels under the Parcels Post Act of 1882.

It is impossible here to give a full description of the processes by which the Clearing House attains its ends, but a general idea of its methods may be gained from the following sketch. To take passenger traffic first:—When a passenger buys a through ticket, he pays to the issuing company a sum which covers his conveyance not only over that company's line, but it may be over the lines of a half dozen others, and the problem is how to ensure that those others get their fair proportion of the money he has paid. To that end a monthly return of through tickets (*i.e.*, of tickets to places on foreign lines) issued at each station is sent to the Clearing House, which credits each company with the amount due to it, proper attention being paid to any special agreement that may exist between the issuing company and the railways over which the ticket is available, in modification of the ordinary apportionment by mileage. For instance,

[1] It is interesting to notice that it was at the initiative of Sir James Allport that the railways first began to deal directly with the traders instead of allowing the "carriers" to act as intermediaries.

when the Midland at St. Pancras issues a ticket to Glasgow, it takes possession of money, part of which belongs to itself for conveying the passenger from London to Petterill (near Carlisle), part to the North-Eastern, over whose line he passes from Petterill to Carlisle, and part to the Glasgow and South-Western, which also has to pay out something to the Caledonian for use of the line from Carlisle to Gretna, and of the Glasgow and Kilmarnock joint railway. The business of the Clearing House is to see that the Midland disburses to those companies the share that belongs to each. But the Glasgow and South-Western, having in its turn issued tickets to Midland stations, is in possession of monies which belong to the Midland; the indebtedness of the Midland to the Glasgow and South-Western is therefore set off against the indebtedness of the Glasgow and South-Western to the Midland, and when the balance is struck it may be that only an insignificant sum has to pass between the two parties.

But in addition to the through ticket there may be the further question of a through carriage to be considered. The practice of running through carriages has increased very rapidly of late years, and now they may be found not merely on what are obviously main routes of traffic, but also on various cross-country journeys — *e.g.*, Liverpool to Penzance, Newcastle to Cardiff, Newcastle to Bournemouth, Southampton to Cardiff, etc. In such cases, in addition to the various companies concerned being credited with sums which are generally proportionate to the mileage over which each has conveyed the holder of the ticket, each has

also to be debited with a charge for the use of a vehicle which, though not its own property, has probably been used at different points on the journey for its own local passengers, from whom the owner gets nothing in the way of fares. The determination of the amount to be paid for this use of foreign stock adds another item to the account. Still another has to be adjusted, if, as often happens, the through carriage is not returned with due promptitude to its owners; a charge for "demurrage" is then made, varying from ten shillings a day for a passenger coach containing first-class compartments, to six shillings for a second or third-class vehicle.

In regard to goods traffic, the functions of the Clearing House are much the same as for passenger traffic, and are performed on the same lines. But, while the passenger trains running on any particular railway are very largely composed of stock owned by that railway, it is the exception rather than the rule to see a goods train all the wagons of which belong to the same company. In other words, through goods wagons are far more common than through passenger vehicles. Consequently the task of tracing them is heavier, and is not lessened by the fact that, while through passenger coaches for the most part only run between regular prearranged points, a goods wagon may be sent to any station on any railway to which its load may be consigned. Moreover, there are often alternative routes by which it may travel, and, before the Clearing House can make any apportionment between the companies concerned, it must obviously ascertain what route it actually did follow. This

information it obtains through the "number-takers," who are stationed at over five hundred junctions to record the number, owner, destination, and starting-point of every wagon that passes through, provided it is a foreign wagon belonging to some other company than the one which owns the line; if, however, a train contains no foreign wagons, that fact has also to be recorded. These records are all sent up to the Clearing House, which is thus enabled to follow the movements day by day of every truck during the time it is off what may be called its native territory, and to settle the accounts for mileage and demurrage accordingly. The demurrage charge for an ordinary wagon is three shillings a day, more being required for wagons of large capacity or of special construction. The tarpaulins with which the load is sometimes protected also come under the cognisance of the Clearing House; they are checked by the "number-takers" at the same time as the wagons, and if they are detained beyond the stipulated time are charged sixpence for the first day, and one shilling for every succeeding day up to sixty, when it is considered that their owners have received about as much as they are worth, and no further charge is made.

Of the contents of the wagons the Clearing House is kept informed by means of two abstracts, supplied to it by the sending and the receiving stations respectively. If these two abstracts, of which one (that made up by the sending station) is in black and the other in red, do not agree in the particulars they give of the character of the goods, their weight, the amount paid or to be paid, etc., the disagreement is pointed

out to the two stations, and steps are taken to discover the cause of the error. When this has been done, or if in the first instance the abstracts were in agreement, the Clearing House proceeds to divide the sum charged for the carriage of the goods between the different railways concerned, in proportion to the distance over which each has carried them. Before doing so, however, it has to make an adjustment between the railways of the amounts due to each in respect of services rendered at the terminal stations. If any of the parties has been obliged to "pay out" money for such things as pier-dues, or special fees for collection, it has to see that repayment is made. If the goods have been damaged or lost in transit, it has to debit each company with its share of the amount paid as compensation.

By similar methods the Clearing House deals with the through parcels, fish, and other traffic conveyed by passenger train, and finally it crowns its services to the public by providing a central office, by means of which many thousands of articles lost in railway carriages are duly restored to their owners.

CHAPTER III

RAILWAY ADMINISTRATION: TRAFFIC DEPARTMENT

Board of Directors—General Manager—Superintendent of the Line—Separation of Commercial and Operating Branches—Devolution of Duties—Time-Tables and the Arrangement of Trains—Punctuality—Composition of Trains—Overcrowding.

CONSIDERING the large number of railway companies in the United Kingdom, their differences in size, and the variety of the conditions with which they have to cope, it would be unreasonable to look for complete identity in the methods of administration they adopt, or to suppose that they are exempt from the operation of the law that special necessities lead to the evolution of special expedients. At the same time, they are all engaged in the same business, and there is in consequence a general similarity in their arrangements which renders possible a broad outline of their organisation and management, applicable to most at least of the principal companies in its main features, though perhaps to none in every particular. It is such an outline that will be attempted in the present and succeeding chapter.

The ultimate management of a British railway company, like that of other joint stock corporations, is

vested in a board of directors, elected by the shareholders, with a chairman and a deputy-chairman or deputy-chairmen chosen by the directors from among their own number. Broadly speaking, the function of a board of directors is rather to control the general policy and finance of the company, and to see that the salaried staff carry out their duties efficiently and economically, than to take any considerable part in the direct administration of its affairs. But on most of the great British railways the directors' duties are of a more detailed character. The chairman is often a man who devotes the bulk of his time to the needs of the company, attending its offices as regularly and continuously as do its salaried officials. The ordinary directors also do a great deal beyond putting in an appearance at board meetings and drawing their fees. It is a common arrangement for them to be divided into a number of committees—traffic, finance, stores, permanent way, locomotive, etc.—acting in conjunction with the heads of the chief departments, the result being that they are kept in close touch with the work of administration. For instance, the "finance committee" will be in intimate relations with the secretary and accountant, the "locomotive committee" will consult with the locomotive superintendent, the "permanent way committee" will, in concert with the engineers, consider questions relating to the maintenance of the permanent way and engineering works, and the "hotels committee" will supervise the management of the hotels, refreshment rooms, and dining-cars owned by the company. These committees hold regular meetings, and report their proceedings

and recommendations to the full board, by whom they are approved or not, as the case may be, nothing of importance being authorised until it has received the sanction of the particular committee into whose department it falls. In addition, members of the board are usually selected to represent the company on the governing committee of the Clearing House, and on the joint committees that look after the affairs of railways in which it has a joint interest along with other companies.

The chief administrative official is the general manager, who stands in much the same relation to the board, or rather to the chairman, as the adjutant does to the colonel of a regiment. As a rule, he is not a member of the board, though there are cases in which a "managing director" is entrusted with his duties; but he is not infrequently elected a director on resigning his position. On a small line the general manager may be practically the sole administrator of the company's business; but on a large one his responsibilities, though far heavier, are perhaps more limited in scope.

The fundamental object for which a railway company is established is to supply what may be called the commodity or service, "railway transportation." In so doing, it combines two functions. On the one hand, it owns and maintains a particular sort of road adapted for vehicles of a particular kind; on the other, it is an organisation having for its end the utilisation of such roads as a means of conveying traffic. Theoretically, these functions are distinct, and a company may—indeed in some cases does—content

itself with owning the line, and leave to others, on payment of a toll, the task of working the traffic, in much the same way that a highway authority provides a highway, but has nothing to do with the vehicles that use it. In general, however, the company which owns the railway also works the traffic, and thus the two functions are combined. Yet the existence of these two functions is often plainly reflected in the duties assigned to the general manager. On several of the big lines he is primarily an expert in the art of railway transport, and as such he is more particularly in control of the departments which have to do with the actual movement of traffic, not of the departments which are concerned with maintaining the property which the company owns in lines, stations, etc., in proper order and repair, or of those whose business it is to keep the accounts of its revenue and expenditure. At the same time, although the heads of the departments engaged in these two latter branches of administration are responsible to the board directly, not to him, their work is so intertwined with that of the traffic branch that their main operations are brought under his cognisance, and their more important proposals receive his approval before being carried out. In this way he gains the connected comprehensive knowledge of the affairs and needs of the company, both as the owner and the worker of a railway, which is necessary to him as the chief adviser of its board and its chief representative in its parliamentary business, and its negotiations with other companies.

As head of the Traffic Department, the general manager has under him two main officials, each with

a long line of subordinates. These two are the superintendent of the line and the chief goods manager, to whom, on railways that have to cope with very heavy mineral traffic, there is sometimes added a mineral manager, who relieves the chief goods manager of so much of his work as relates to the carriage of minerals. The goods manager is in charge of the task of canvassing for goods traffic, arranging the charges upon it, carting it to and from the goods stations, loading and unloading the railway trucks that carry it, and making them up into trains for conveyance to their destinations. The superintendent of the line combines two functions. In the first place, he does for passenger or "coaching" traffic pretty much what the goods manager does for merchandise traffic; and, in the second, he has the more technical work of supervising everything that has to do with the movement of traffic of all descriptions over the railway, and with the actual running of all trains, whether they be passenger, goods, or mineral, except that the business of supplying the necessary engine power is in the hands of the locomotive superintendent.

This division of duties, though it is the one in force in the majority of British railways, has not escaped criticism. Under it the traffic management, it is urged, is obliged to spend much of its time on routine office work of an ordinary character, instead of being free to devote its energies to the technical problems involved in the economical handling of the traffic; and it is suggested that, however sufficient the old system may have been for the times when it originated, the complex conditions under which railway traffic has

now to be worked require the undivided attention of men who have made them a scientific study. Holding views of this sort as to the advisability of separating the commercial and the operating branches of administration, as is done on American railways, the directors of the North-Eastern at the beginning of 1902 established a new organisation of their Traffic Department, which is designed to effect this separation, and shortly afterwards the Great Northern adopted a similar rearrangement. It may be noted, however, that long before that date the Lancashire and Yorkshire had created the office of chief traffic manager, with a separate passenger superintendent and goods manager, and that on the North Staffordshire Railway the operating and commercial branches have been kept distinct since the early 'eighties.

According to the North-Eastern arrangement, the superintendent of the line became general superintendent of the operating branch, with extended authority, the commercial duties which he formerly performed being transferred to a new department (of the commercial branch) under a chief passenger agent. In this way he was relieved of a mass of office duties which tended to withdraw his attention and energies from his main duty of handling and working the traffic promptly and economically. At the same time, the centralisation in him of all duties connected with the working of the traffic was completed by entrusting to him the functions of that kind formerly performed by the chief goods manager, who was thus left with only commercial duties and the office work involved by them. The following official

particulars of the duties assigned to these three officials—the general superintendent, the chief goods manager, and the chief passenger agent—will serve to give an idea of the nature of the work, however distributed, which is done in the Traffic Department of a great British railway:—

Department of the General Superintendent.—The general superintendent is charged with the administration of the department of the company's business connected with the running of trains and the handling and carriage of traffic of all kinds on the company's railways, docks, and wharves. This department includes the following duties:—

1. Supervising the safe and proper working of the railway stations, warehouses, yards, sidings, docks, and traffic appliances.

2. Supervising the loading, unloading, and handling of traffic.

3. Fixing the times and traffic arrangements for running all trains, and supervising the running thereof.

4. Submitting proposals for the equipment required for trains and for works and accommodation required for traffic of all kinds.

5. Controlling the ordering-out of all locomotive engines for traffic purposes.

6. Controlling the train-mileage run to carry the traffic.

7. Controlling the supply and distribution of carriages and wagons.

8. Preparing all time-tables and time-bills for issue to the public, and preparing, distributing, and issuing to the working staff all time-tables, notices,

and instructions in connection with the working of the company's railways and docks and the traffic thereon.

9. Examining and reporting on all applications from traders in connection with private sidings.

10. Dealing with claims under the Workmen's Compensation Act.

11. Supervising the use of the company's telegraphs and telephones.

12. Enforcing the due and proper observation of all rules and regulations of the company in connection with the working of the railway and docks and the traffic thereon.

Department of the Chief Goods Manager.—The chief goods manager is charged with the administration of the department of the company's business connected with securing and charging for goods traffic, which expression as used herein comprises merchandise, live stock, and mineral traffic, except fish carried under fish waybills. This department includes the following duties:—

1. Collection of information as to trade movements and developments and as to railway facilities required by traders and for goods traffic, and submitting proposals with reference thereto.

2. Fixing and quoting rates and charges for all services in connection with goods traffic, and keeping all proper rate-books.

3. Canvassing for and securing goods traffic.

4. Preparing and dispatching invoices or obtaining declarations of all goods traffic loaded for carriage.

5. Collecting charges for goods traffic, except

charges for certain mineral traffic collected by the accountant.

6. Advising the general superintendent as to the accommodation and train services required for goods traffic.

7. Supervision and control of goods agents and stationmasters in relation to their commercial duties in connection with goods traffic.

8. Dealing with all claims in connection with goods traffic.

9. Cartage of goods traffic, and supervision of carriage staff and plant.

10. Examining and reporting on all applications from traders in connection with private sidings in regard to questions of rates or charges, and keeping records of all particulars in regard to private sidings.

11. Examining and reporting on all questions in regard to the routing of and division of receipts for through goods traffic.

12. Preparing and issuing notices as to carriage of live-stock traffic in districts affected by cattle disease, and similar special notices affecting the carriage of any kind of goods traffic.

13. Dealing with the allotment of coal cells, and supervising the coal cell agencies.

14. Controlling the supply, distribution, and repair of sacks provided by the company for goods traffic.

Department of the Chief Passenger Agent. — The chief passenger agent is charged with the administration of the department of the company's business connected with securing and charging for passenger traffic and all traffic carried by passenger trains

usually known as coaching traffic, including fish carried under fish waybills. This department includes the following duties:—

1. Fixing fares and rates for coaching traffic.

2. Preparing, printing, and issuing tickets.

3. Canvassing for and securing excursion traffic and all coaching traffic, including supervision of the agencies and receiving offices for dealing with any of this business.

4. Preparing, distributing, and issuing all advertisements in relation to coaching traffic, except ordinary time-tables and time-bills.

5. Distributing and issuing the public time-tables prepared by the general superintendent.

6. Advising the general superintendent as to the train service required for the accommodation of the public.

7. Collecting charges for coaching traffic.

8. Collection and distribution of information as to trade movements and developments, and as to events of a public or private nature likely to affect the company's coaching business, or to require special provision to be made therefor, and submitting proposals with reference thereto.

9. Supervision and control of booking and parcels offices, and of the collection and delivery of parcels traffic.

10. Dealing with all claims in connection with coaching traffic.

11. Supervision of trade advertising on the company's property.

Each of these officials stands at the top of an

organisation of assistants, through whom the chain of responsibility is carried down to the lowest grades among the servants of the company. Thus the general superintendent has below him three divisional superintendents, each having complete and undivided control in his own district of all working operations connected with all kinds of traffic—passenger, goods, minerals, docks, etc. Similarly, subordinate to the chief goods manager and the chief passenger agent, are five district goods managers and two district passenger agents, each in their respective districts attending to the commercial work of the department to which they belong.

The same sort of devolution is adopted on other lines which do not favour the particular arrangement and nomenclature of headquarters staff introduced by the North-Eastern. For instance, on the North-Western there are five district superintendents, five district traffic superintendents, and eleven district goods managers, distributed at the most important centres. The first-named are subordinates of the superintendent of the line, and are engaged in the same sort of work as he is; the last are attached to the Goods Department, and have nothing to do with passengers or the running of trains; while the district traffic superintendents combine the functions of both these sets of officials, and therefore have relations both with the superintendent of the line and with the chief goods manager or his assistants.

Lower still down the scale come the stationmasters, who, in most cases, have the supervision of both goods and passenger traffic. At the most important places,

however, especially where the depôts for the two classes of business lie apart, there are two officials—one, the stationmaster, who has to do with passenger work, and is responsible to the department of the superintendent of the line; and the other, the goods agent, who comes under the control of the goods manager. Stationmasters are the chief executive officials in and about the stations to which they are attached, and are responsible for their proper working in every respect — for the control of the staff, including porters and signalmen, the supply of stores, the management of trains within the area of the station, the issue of tickets, the money received and paid out, etc. At an important station they thus have a wide discretion and considerable responsibility in supervising many diverse operations and a large body of men; at a very small one, a single individual may now and then be found doing the whole of the work without assistance.

One of the most exacting duties allocated to the superintendent of the line is the preparation of time-tables; and no one can have any conception of the magnitude and complexity of the task who fixes his attention only on the mere abstracts that are printed in the public time-table books of a company or pasted on notice boards at its stations. In the first place, these refer exclusively to passenger trains, and entirely ignore goods and mineral trains, which, if judged by the test of train-mileage, are in this country scarcely less numerous. In the second place, even so far as passenger trains are concerned, these public time-tables omit many particulars—to mention one, the times at

which the trains are due to pass stations at which they are not booked to stop—which are required by the officials in charge of the traffic. The real time-table of a railway is the working time-book, which gives details of the running times of every regular train on the system, whether it be passenger or goods, or a set of empty carriages going to and from the sidings where they are placed for the night, or a light engine running to or from the locomotive shed where it is stationed. Further, special notices have to be issued at intervals as required, informing the staff of the arrangements made for irregular or special trains run to accommodate visitors to race meetings, football matches, etc., and for the increased service which is necessary for a few days at certain periods of the year, such as Christmas and Easter. Again, minute and detailed instructions are distributed among engine-drivers, signalmen, guards, and others concerned, containing directions that the whistle must be sounded so many times on approaching certain junctions; that train number 123 must be shunted at such and such a junction to allow number 456 to pass it; that the engine of train number 321 has to run train 213 to a certain place and back, or undertake so much shunting at such and such yard; that the load of a certain train is not to exceed a certain number of vehicles over a certain section of line; and many other details of a similar sort. Special notices, too, have to be given of operations of the Engineer's Department, such as the relaying of a length of permanent way, the renewal of a bridge, and changes in the arrangement and position of outdoor signals.

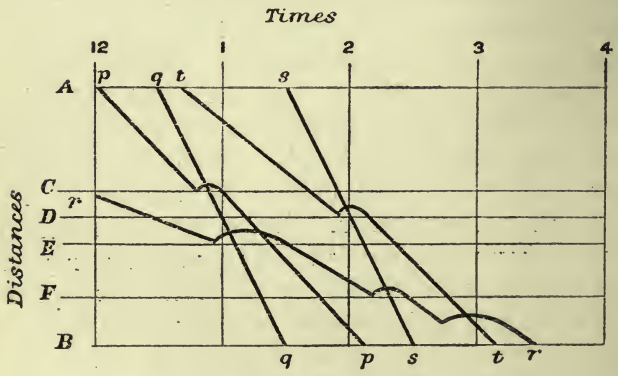
Apart from the time and labour involved in their preparation, the mere cost of printing and distributing new time-tables is no inconsiderable matter, and therefore is not incurred oftener than is absolutely necessary. Although some alterations in the train service are almost inevitable from month to month, the main revisions take place twice a year only. From July to September, when pleasure-travelling is at its height, and when also there is a shrinkage in goods and coal traffic, the summer time-tables are in force, providing a larger service of passenger trains than is required during the remaining months of the year, when goods traffic grows heavier and there is a falling-off in the number of passengers, whether ordinary or excursion. Of course, in their main features, the time-tables stand from season to season, and to that extent the labour of revision is reduced. But, even so, the growth of traffic, the development of new neighbourhoods and places of resort, demands on the part of the public for new trains, the enterprise of rival railways in giving new services which it is thought necessary to counter, afford ample scope for the talents of the train organiser. Proposals for new or altered trains are considered by the superintendent of the line, who examines them in the light of reports from various officials in his department, and, if he thinks them desirable and practicable, they go to the general manager and the traffic committee of the directors for final ratification. This being obtained, the precise working times are arranged by the co-operation of officials from the various sections of the line, and their results form the basis of the tables,

which are subsequently printed and issued to the public.

That a change in the timing of an important through express is not a thing to be lightly undertaken is obvious, from the consideration that it may mean the alteration of scores of other trains, in order to maintain a clear road for it and to secure connections at important junctions. The same is true of a new train, with the addition that there is the further problem of arranging a second new train in the opposite direction to balance the first. It may easily happen that, although there would be a paying load in one direction, there would be little or no traffic in the other, and in such a case an economical manager very properly hesitates before he authorises the new mileage. Yet it is not uncommon to hear a few business men, who perhaps on other occasions are fond of descanting with virtuous indignation on the extravagance and wastefulness of British railway administration, abusing the line on which they live because it does not happen to run a train up from their rural retreat to the city exactly at the time they would desire, and declines to put one on for their sole accommodation. Similar unreasonableness is often shown in demands for the stoppage of express trains at a wayside station; it seems to be supposed that to stop a train running at sixty miles an hour means nothing more than shutting off steam and applying the brakes, and no account is taken of the loss of time and the wear and tear thus occasioned.

If all the trains on a line were of exactly the same speed, the arrangement of a time-table would be a

comparatively simple matter. In practice, however, what the traffic manager of an ordinary double-track line has to contrive is that one pair of rails shall accommodate trains of all speeds, from expresses timed at fifty or fifty-five miles an hour, down to heavy mineral trains travelling at only one quarter that rate. If the number of trains is small, no great difficulty is felt, but on a crowded through line the case is very different. A complicated system of shunting slow trains into refuge sidings, to make way for fast ones, then becomes necessary, and in arranging this a useful adjunct is found in the shape of charts or diagrams which show in a graphic form exactly how the line is occupied at any instant—or at least how it should be occupied if every train is up to time. The principle may be seen from the accompanying diagram, on



which the vertical lines represent times, the horizontal ones distances, and the diagonal ones trains. A slow train, *p*, timed to run twenty miles an hour, leaves

A at 12, and at 12.30 is followed by an express *q*, which has to run the whole distance of forty miles from *A* to *B* in one hour. *p* and *q* will thus be at *D*, half-way, at the same time, and *q* will be blocked by *p*. To prevent this *p* is shunted at *C*, a station a few miles before *D*, to allow *q* to pass, the delay being indicated by the curved line. At *E*, train *q* overtakes a goods train *r*, which is accordingly put into a siding, and is kept there until *p*, which is close at hand, has also passed it. Subsequently *r* has to shunt for the express train *s* and the ordinary passenger train *t*. The utility of such diagrams may be seen by considering the proposal to run a new express from *A* to *B* at, say, one o'clock. A glance at the chart shows that it would mean interference with no less than three existing trains; if, on the other hand, it were made to start at 2.30, it would get through without interfering with other traffic at all.

A train, however, such as a slow goods train, which has to do a variable amount of shunting at wayside stations, it is almost impossible to arrange with perfect precision. Its work one day may be particularly heavy, on the next day abnormally light. In the latter case it will be ready to start before its appointed hour, and to delay it is simply wasting time. In the former, it will not have time to reach the usual siding where it ought to wait until a following express has passed it, and therefore must be shunted somewhere else. Or the express which governs the movements of the other trains may be half an hour late, and it is obviously undesirable to hang up all the traffic on the line for so long a period pending its arrival. Hence a

great deal has, even with the most perfectly arranged time-tables, to be left to the discretion of the signalmen, who, however, act in the light of certain definite rules laid down for their guidance. The cardinal principle is that, in general, precedence must be given to passenger trains over goods trains, and to express trains over slow ordinary passenger trains. Hence a goods train must not be permitted to leave a station if it is likely to block the line for a following passenger train; the interval to be kept between the two is for many stations definitely stated in the instructions issued to the staff. In deciding whether he shall permit a particular train to proceed or not, a signalman is greatly helped by the telephone and telegraph, by means of which he may be informed of the progress of the trains that will ultimately pass his cabin. Occasionally, too, he can apply for instructions to a central official, who in giving them acts in a capacity bearing some distant resemblance to that of the American "train-dispatcher."

The greatest enemy to ordered running is a thick fog, which reduces even the best time-tables to impotence, and is apt to produce complete disorganisation in the train service. The ordinary visible signals being hidden from the view of the driver, their place has to be supplied as well as possible by audible signals, given by detonators which are placed on the rails and exploded by the wheels of the engine as it passes over them. Elaborate arrangements are made by the superintendent of the line for procuring the fogmen who put the detonators in position; they are usually men who would, if the weather was clear, be

employed on the permanent way, but sometimes, in the case of long continued fog, it becomes necessary to have recourse to other grades of the railway service. As soon as a fog comes down, a "fogger," with a little hut and a fire to protect him from the worst rigours of the weather, is placed at the foot of each "distant" signal-post, and it is his business to keep on the rails, so long as the signal-arm is at danger, a couple of detonators, by the explosion of which the engine-driver may be informed that the road is not clear, and that he must be able to stop by the time he reaches the "home" signal, which forms the real protection of the station. As soon as the arm falls to the "all right" position, the fogman removes the detonators, at the same time showing a green light to the approaching train, the driver of which then knows that the line is clear for him. The reason why two detonators are placed on the rail is to guard against the risk of a miss-fire; a single explosion, just as much as a double one, indicates to the driver that the signals are against him.

The maintenance of as high a standard of punctuality as possible is a matter of great importance, for on it depends in large measure not only the reputation a railway enjoys with the public, and consequently the amount of traffic it can attract, but also the economical handling of that traffic when obtained and the carrying capacity of the line. Hence an elaborate system of returns and reports is put at the disposal of the superintendent of the line, to aid him in checking the punctual running of the trains. Signalmen, for instance, are required to book the times at which they

exchange the block signals on their telegraph instruments with the signal-boxes on each side of them, and guards have to keep records of the times at which the trains under their charge reach and leave various stations and signal-boxes, and to note the causes that have led to delay—such, for example, as that so many minutes were lost at A because the signals were at danger, or that there was a "permanent way slack" at B owing to the operations of a relaying gang. Still, in spite of all precautions, occasional lapses from punctuality, as has already been indicated, are absolutely unavoidable. What a well-managed line strives to avoid is persistent unpunctuality. Hence, when it is noticed that some particular train day after day runs behind its schedule time, a close inquiry is instituted, and probably a travelling inspector accompanies it on its journey for a few days to find out how and where the time is lost. On a line that has a reputation to maintain, every effort is made to remedy the defect when discovered, and, if nothing else will serve, an alteration is made in the times of the offending train, or those of other trains by which it is delayed. But, on some lines, it must be admitted either that no travelling inspectors are employed, or that their reports are consistently ignored at headquarters. Almost every traveller with a moderate experience of suburban railways around London can point to trains which maintain their places in the time-tables unaltered from month to month, and from year to year, though they run up to time only upon the rarest occasions.

It is on such slack lines that another duty of

the Superintendent's Department is most frequently neglected—that of intelligently anticipating the total number of passengers with the proportions that use the different classes of carriages, and of regulating the composition of the trains accordingly. Perhaps a train whose passengers are mainly third-class is made up mostly of first-class coaches, or perhaps all the second-class compartments are given over to a party of soldiers or a school-treat without any extra provision being made for the normal second-class traffic of the train. Whatever the precise mode of mismanagement, the result is the same. When the train at length reaches a ticket-collecting platform, the guard may be heard laconically to say the word "Mixed" to the collectors. People who have paid first-class fares may then know that, besides being deprived of that for which they have paid, by being obliged to travel in carriages filled (perhaps beyond their proper complement) with second- and third-class passengers, they are not even to have the poor consolation of seeing excess fares exacted from the authors of their discomfort. However painful the fact may be to the moralist, there can be little doubt that this sort of thing, which seems rather commoner on Sundays than on week-days, leads to a certain demoralisation among railway travellers, and disposes them to feel that there is no harm in "getting the better" of a railway company if occasion offers. It would be a relief to honest travellers, and in the end an advantage to the railways themselves, if it were enacted that the class of a particular compartment is to be determined, not by the label on the door, but by the tickets held by its occupants, and

if the passenger who is obliged by the absence of adequate accommodation to travel with people holding tickets of an inferior class, were given a right to require repayment of the difference between his fare and theirs.

There are, however, cases in which the provision of sufficient accommodation constitutes a problem of extreme difficulty, and overcrowding becomes almost inevitable. On some lines the rush of passengers at certain times of the day is such that it is physically impossible to cope with it, even by the longest trains with the most capacious carriages, run at the shortest intervals possible. It is easy to say that in such circumstances the railways should add to their lines and stations. But the press of traffic only lasts for an hour or two, and for the rest of the day the existing lines may be ample: in such a case a company cannot be blamed for hesitating to spend capital on which a fair return is not to be hoped for. Moreover, there is the perversity of human nature to be reckoned with; and sometimes people seem to persist in travelling by one particular train, however overcrowded, although there are other trains, substantially as fast, just before and just after their favourite. The British workman has been known to stand and deliberately watch a comparatively empty train depart, preferring to wait three or four minutes for the very last one that will serve his purpose, even though daily experience tells him that it will be crammed to far more than its proper capacity.

CHAPTER IV

RAILWAY ADMINISTRATION: OTHER DEPARTMENTS

Secretary and Accountant—Stores—Engineer—Maintenance of Way—Signals—Electrical Engineer—Locomotive Superintendent—Carriage and Wagon Superintendent.

AFTER the general manager, the secretary is perhaps the most important of the salaried officials of a railway company, of which, for legal purposes, he is the representative. In many respects his duties are much the same as those of secretaries of joint stock companies in general. Thus he has to issue the notices of meetings of directors and shareholders and to keep the minutes of the proceedings. His name often appears at the foot of his company's advertisements for tenders, contracts, etc., and he signs the public notices of bye-laws, etc., exhibited at the stations. The seals of the company are under his guardianship, and he issues stock, looks after the registers, and records transfers. Further, he generally acts as the treasurer of the concern, having charge of the cash, giving receipts, receiving rents, keeping the cheque-books, and preparing dividend warrants. Associated with him in the financial administration is the accountant, whose function, broadly, is to keep the accounts of the money

which passes in and out of the company's coffers, and to check and enter all the payments and receipts, the secretary's being rather to handle the cash. With its staff of auditors, bookkeepers, etc., the Accountant's Department is thus responsible for the sufficiency and accuracy of the books in which the numberless financial transactions of the company are recorded; and it has to deal, on the one hand, with totals which, like the half-yearly balance-sheets, run into millions of pounds, and, on the other, with the minute accounting precautions which are required to prevent the leakage of a shilling at the remotest country station. The amount of the clerical work, and the complicated nature of the operations of the accountant's office in a big railway, may be imagined when it is remembered that there are several British railways which each has a gross income exceeding ten millions sterling a year (the North-Western has over fourteen), that contributions to these totals are made from literally hundreds of stations, each of whose accounts must be closely scrutinised and checked, and that about three-fifths of the immense sums received have to be disbursed again for working expenses of various kinds, the rest being paid away as interest on debentures and as dividends.

The Stores Department is another important branch of the headquarters administration. Its function is to undertake the shopping required for the line, and it may be said to keep a general store on a very large scale, buying materials of all sorts required in the maintenance and working of the railway, and distributing the various articles among the other departments

as required. Its superintendent, therefore, has to be acquainted with all the needs of the railway, from coal for the locomotives and steel for the rails down to clothing for the men and paper for the invoices. He has to see that the stock is sufficient to supply what is wanted without delay, to know the best producers and manufacturers with whom to deal, to watch and even anticipate the course of the markets, so as to be able to make his purchases and place his contracts on the most favourable terms, and to make certain, by a careful system of inspection and testing, that the goods are supplied in the quantities ordered, and are of the nature and quality described in the specifications. Issuing nothing from his stores except upon proper requisition from the department concerned, he keeps strict account of what he buys and what he parts with, and thus can readily tell what stock he has on hand and detect the occurrence of waste or loss. He also has charge of the disposal of old materials returned from the various departments.

The Engineer's Department is made up of two main branches, controlled, however, by a single head—the one occupied in the construction of new lines, buildings, and works of all kinds, and the other with the maintenance of those already in existence. In regard to the former, the chief engineer, in the case of a completely new piece of line, has charge, either alone or in co-operation with the consulting engineer, of making the surveys, drawing up the plans, estimating the costs, and in general getting together the engineering particulars with which an application to Parliament for fresh powers must be supported. If the applica-

tion is successful, and it is decided to proceed with the scheme, he is responsible for supervising its progress and seeing that it is carried out in a satisfactory manner, whether the execution of the new works is undertaken by the railway company's own staff, or whether, as is often the case (especially when it is a question of constructing a heavy length of line or of putting up new buildings on a large scale), a contractor is employed. The choice between these two courses is determined by considerations of convenience and cheapness. Expenditure on such matters as rebuilding stations or providing additional sidings may or may not be too frequently charged to capital account by British railways; but, in any case, it is very carefully scrutinised before being allowed, and there has to be a general consensus of opinion among the various officials concerned, that, in any particular case, it is not only desirable, but necessary, before it wins the authorisation of the directors and chairman.

In regard to maintenance of way and works, the chief engineer stands at the head of a long series of subordinates, by means of whom his control is extended to the smallest details in all parts of the line. Immediately below him there may be an assistant specially devoted to maintenance work, and of equal rank with another who has to do solely with new construction. Then come a number of divisional engineers, each in charge of the lines in a specified area, and below them are district engineers and inspectors, who again have under them the gangs of platelayers who actually do the work. To each of these gangs, consisting of some half dozen men with

a foreman, is assigned the care of a section of line. Like the precise length of the sections, the size of the gangs varies according to circumstances, such as the amount of traffic and the number of tracks, sidings, and junctions, but a rough average is one man to each mile of single line. Whatever the length of the section, the platelayers patrol it once a day or oftener, in order to ensure that it is in every respect kept in perfect running order. Thus they have to see to such things as that the gauge and levels are true, the bolts of the fishplates joining the rails tightly screwed up, and the wooden keys firmly wedged in between the rails and the supporting chairs. Further, it is their duty to report any irregularities or failures they may notice in respect of telegraph wires, signals, bridges, culverts, etc. Periodical inspections are also made by the higher officials and the directors, to ensure that all the work is being properly performed, and that a uniform standard of maintenance is kept on all parts of the line. Besides the "straight-road" gangs who look after the ordinary repairs, there are special relaying gangs who travel from place to place and undertake the complete renovation of the permanent way at different points as required.

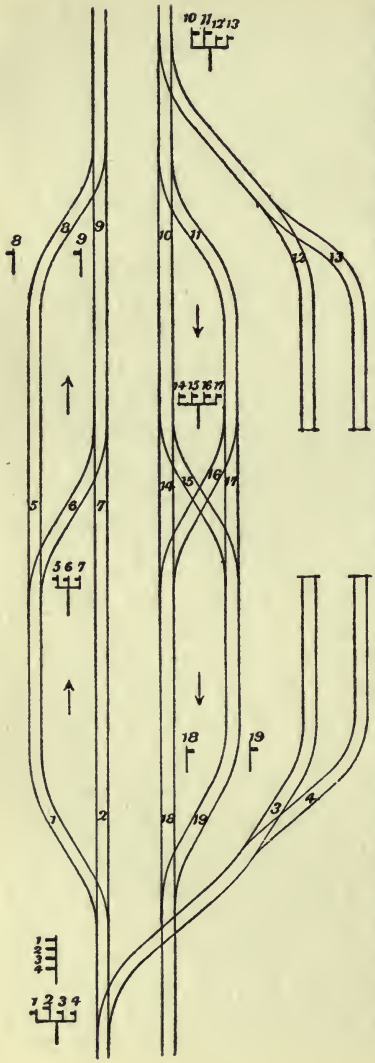
In addition to being responsible for the maintenance of the permanent way on which the trains run, the Engineer's Department has also to maintain and repair the signal apparatus by which their running is regulated and they are prevented from coming into collision one with another. British railways are worked on the block system, which means that a certain space —not, as used to be the case in the earlier days of rail-

ways, a certain time—is kept between each train. The whole line is divided into block sections, which may vary in length from a few hundred yards up to several miles, and the principle of the absolute block system is that two trains, travelling on the same rails, shall never be in the same section at the same time. In what is known as the "permissive block" this rule is relaxed, so that in certain circumstances two trains are allowed in the same section together.

These sections, each having a signal-cabin of its own, are each guarded by outdoor or fixed signals of the semaphore type familiar to every railway passenger. The first signal a driver sees on approaching a signal-box is the "distant" signal, which is distinguished from all others by having a deep notch cut in the end of its arm. Its office is to inform the driver whether the next or "home" signal is at danger or not. If he finds it in the "all right" (down) position, he runs past it, knowing that the home signal is also showing "line clear." If it is at danger, he equally runs past it; but knowing that the home signal must necessarily be at danger at that moment, since the mechanical arrangements are such that it cannot possibly be lowered until the home signal has been lowered, and that it may be still at danger by the time he reaches it, he shuts off steam and reduces his speed, so that he will, if necessary, be able to stop before he passes it. Beyond the home signal he may encounter other signals, such as "starting" and "advance-starting," and these he must not pass if they are at danger; they are, however, subsidiary to the home signal, which is the most important one of the station or section.

The Board of Trade issues regulations prescribing the general principles on which all these signals are to be arranged, but it rests with the signal engineer of the railway, in concert with officials of the Traffic and Locomotive Departments, to determine the exact positions which each shall occupy, and any subsequent change in those positions has also to be approved by the same departments.

The main consideration is to ensure that the signals shall be visible from as great a distance as possible, that they shall be placed against a good background so as to be as distinct as possible, and that they shall be so disposed as to reduce to its smallest dimensions the risk of mistake on the part of the engine-drivers. The array of signals at a big station often looks very complicated, but in reality their arrangement is based on a perfectly simple plan. The guiding principle is that, of a number of signals controlling a group of lines, the one which is on the extreme left refers to the line on the extreme left, the second to the second line from the left, the third to the third line, and so on. Take, for illustration, a station having four running lines through it, with several bays for the accommodation of local trains. Then, omitting for simplicity the signals which control the exits of trains from the bays, and also the distant signals, the arrangement would be of the general character shown in the diagram on the next page, in which each road is marked with the same number as the signal-arm by which it is guarded. Everything, it will be noticed, both roads and signal-arms, number from the left, in correspondence with the rule observed in Great Britain that the



trains keep to the left. In America the trains keep to the right, and in consequence the signals number from the right also, except on the Lake Shore, which follows the British rule of the road, because it is not prepared to incur the expense of altering signals, facing-points, etc., necessary to bring it into line with the practice of American railroads in general, and its own allies and connections in particular. It may be mentioned that sometimes the signal-arms controlling diverging roads are placed vertically one above the other, instead of horizontally as represented in the diagram: in that case, the topmost arm refers to the road on the extreme left, and the lowest one to that which is most to the

right. In modern practice, however, this arrangement is avoided for important junctions, and the signals for each road are usually placed on separate posts or brackets. Instances, of course, are frequent in which two arms referring to the same road are placed on the same post or bracket; but then the lower arm, distinguished by the notch cut in its end, is the distant signal of the succeeding block section, and merely indicates to the driver in what position he may expect to find the home signal of that section. It is so connected (by "slotting") with the arm above it, that until the latter has been lowered it cannot be moved; hence it may stand at danger even though the upper arm shows "all right," but not *vice versâ*; and if they have both been lowered, they are both returned to the danger position simultaneously whenever the upper arm is raised by the signalman in charge of it. Sometimes a small "calling on" or shunting signal is placed on the same post that carries the main running signals referring to the same line.

But at most stations, in addition to signals, there are sidings with one or more cross-over roads to enable trains to pass from the up to the down line and *vice versâ*, and, if safety is to be assured, it becomes necessary to correlate these with the signals. Such correlation is effected by "interlocking" the signals with the points that control the sidings, etc., so that those combinations of the two that would lead to danger are rendered mechanically impossible. If, for example, the points of the cross-over road are so set that a train can move from the up to the down line, then

the signals guarding the approach to the station from both directions must be held at danger, else there will be a risk of a train coming along on one or both lines and running into the train using the cross-over road. Hence it is ensured by means of the interlocking apparatus in the signal-cabin, (1) that the points of the cross-over road cannot be moved to the position in which they give communication from the up to the down line unless the signals of both lines are at danger; and (2) that the signals cannot be moved from the danger position until the cross-over road points have been moved back to the position in which the up and down lines are unconnected. Again, at junctions where two lines unite, it is obvious that for safety it must be impossible simultaneously to lower the signals that control the two converging lines, lest trains on each reach the meeting place at the same moment and come into collision. This possibility is guarded against by interlocking the signals of the two lines with each other in such a way that only one of them can be lowered at a time. The signals controlling diverging roads, too, are so interlocked with the points of the junction that it is impossible to lower any arm but that which is appropriated to the road for which the points are set. The mechanism ("locking-frame") by which all this interlocking is effected is placed in the signal-box in connection with the levers that work the signals and points.

Some of the railway companies undertake at their own works the manufacture of everything they require in connection with the signalling of their lines, but many of them obtain what they want from one or

other of the several large firms which carry on the business of makers of signal plant in Great Britain. Whichever course a railway adopts, its signal department has to supervise both the erection and maintenance of all the outdoor signals and their subsidiary apparatus, including the wires and rods by which the signal-arms and points are worked from the signal-cabins, the interlocking mechanisms, and the numerous safety devices, detector bars, etc., which British railway companies are required to fit in accordance with the regulations of the Board of Trade. To keep everything in proper working order, a system of careful periodical inspection is carried out by the signal superintendent, assisted by an organisation, according to districts, of inspectors, sub-inspectors, and mechanics, who are so distributed over the line that every station and signal-box is visited at frequent intervals, and its signal gear thoroughly examined, cleaned, and oiled. There are also special gangs of mechanics available for effecting repairs and renewals which are more extensive than can be undertaken by the ordinary chargemen.

In relation to the working of the signalling system a very important part is taken by the electrical superintendent or engineer, who has charge of the electrical arrangements used on the railway. The signalling of trains was one of the earliest applications to which the electric telegraph was put; and now it is no exaggeration to say that, quite apart from considerations of safety, to conduct the traffic of a busy line without it would be a complete impossibility. Every signalman, except at a small terminal station, has in his cabin at

least two telegraph instruments—one communicating with the signal-box on one side of him, and the other with that on the other. By means of these he is warned by his neighbour at A on one side when a train is approaching him; he inquires from his neighbour at C on the other side whether the line is open for it to continue its journey past him, and on the strength of the electrical signals thus sent and received he lowers the signal-arms at his own station, B, and at the appropriate times authorises his neighbours to do the same with those under their control. The telegraphic instruments employed consist of bells and of dial instruments. The latter, by means of a needle or a miniature semaphore, give visible indications, such as "line clear" or "train on line," while the strokes on the former in varying numbers and groupings, according to a predetermined code, make audible announcements of the approach of a train and its character—express, fast goods, slow passenger, etc., as the case may be.

In most instances these instruments do no more than instruct a signalman when he is to move his signals; that is to say, it is possible for him to ignore them and act in defiance of his telegraphic instructions, though even so the interlocking apparatus in his cabin might save him from some of the dangerous movements. On a few lines, however, a further safeguard is introduced whereby the actions of the signalman at B are not merely subject to the attention he pays to the visible and audible indications he receives from the signal-boxes on each side of him, but are actually under the physical control of the latter, and

his signals are locked so that he cannot move them until they have been electrically released from A or C. In another system, two trains are prevented from being in one block section together (always provided the engine-drivers do not disobey the signals) by an electrical arrangement whereby the signal controlling the entry of the second train into the section is held at danger until the first train is clear of it. A further development of the "lock and block" system leads to automatic signalling, in which electrical circuits controlled by the train are used, not merely negatively to prevent a signalman from lowering his signals in certain conditions, but positively to operate them without his intervention at all. In all these arrangements the electrical engineer is indispensable, for, although in automatic signalling (which is extensively used on the Pennsylvania Railway in the United States, and in this country has been introduced on the Metropolitan District, the London and South-Western, and the North-Eastern Railways) the actual motive power that shifts the signal-arms is often derived, not from electricity but from compressed air, in every case electricity is the controlling agent.

But the duties of the electrical superintendent on a railway do not end in seeing that the block telegraph instruments in the signal-boxes, with their batteries and connecting wires, are maintained in good order. He and his staff have, in addition, the care of the electrical indicators, by which the signalman is assured that signal-arms which are out of his sight have responded to the pull of the lever, and that the signal-lamps are alight; of the electrical staff and tablet

apparatus for the safe and efficient working of single lines; of the telephonic circuits, which now put a large proportion of the signalmen into speaking communication with each other; and of the thousands of ordinary telegraph instruments, and the tens of thousands of miles of wires in connection with them, which railways require in the ordinary course of their business for sending messages between the various stations of their systems. Further, the lighting of the passenger carriages by electricity, the current being generated by dynamos driven from the axles, has rapidly extended of late years, and its adoption involves the maintenance and care of large numbers of accumulators. Many railways, again, possess big electrical installations for supplying light and power to goods yards and passenger stations, and even, as at Crewe, for working the points and signals. Finally, many electricians are looking forward to a not very distant time when electricity will displace steam as the motive power for the fastest and heaviest trains on the longest journeys. When that comes to pass, the electrical engineer will be a person of even greater consequence than is the locomotive superintendent in the present era of steam.

The locomotive superintendent is usually the chief mechanical engineer of the line to which he is attached, and as such has charge not only of the locomotives, but also of the numberless mechanical devices—engine turn-tables, water-columns, pumps, cranes, hydraulic capstans, stationary engines, etc.—that are required in the working of a railway. Often, too, he is responsible for all the passenger coaches and

goods trucks of every kind, though in some cases these are placed under the care of a separate Carriage and Wagon Department.

His duties may be said to begin with designing suitable engines to haul the different classes of traffic with which the railway has to deal. Here it is obvious that he must be in close touch with the Traffic Department. If the superintendent of the line considers that new engines are required, capable of taking a train of such and such weight at such and such speed, it is the locomotive superintendent's business to supply him with what he wants, or to advise him that what he demands is injudicious or impossible. The last alternative is not one which an engineer regards with much favour, and he probably succeeds in rising to the occasion, not perhaps without a grumble at the unconscionable greed of the traffic people who ask for an engine to take, say, sixteen coaches, promptly run it at the head of a train of eighteen, and then demand something that can take twenty-one. Not the least striking feature in recent railway history has been the enormous increase in the weight and power of locomotives, necessitated by the increasing speeds, and still more the increasing weights, of the trains. Twenty years ago, or even less, it would have been difficult to find engines in Great Britain weighing, with tender, more than about 75 tons; now weights of 100 tons are not uncommon, and the Midland Company's new compounds reach 112 tons. In the same period there has been a rise in the steam-pressures employed, from 140 or 160 lb. per inch to 180 or 200 lb.

The character of the engines having been settled, and the necessary expenditure sanctioned and arranged for by the financial authorities, the locomotive superintendent, with the aid of his drawing office staff, prepares the detailed plans and specifications for their construction. This done, the actual building is taken in hand. Every railway company possesses engineering shops where it can carry out the repairs which are required by its engines from time to time, and in the case of the larger lines these are able also to undertake the entire construction of locomotives. But although some of these engineering shops rank with the finest in the country, both in extent and equipment, it is not every line which, like the London and North-Western, is in the position of being able itself to build all the engines it requires, much less manufacture its own steel, roll its own rails, and generally undertake all the mechanical construction required on its system, as that company does at Crewe, Wolverton, and Earlestown. Most of them have occasionally to resort to outside firms of locomotive builders, who then work to the specifications of the locomotive superintendent; and, a few years ago, such was the demand for engines that several companies had to go to the United States to get their orders placed. It may here be remarked that there is considerable difference between the practice of American and British railways in regard to new locomotives. American lines are often content to order the standard patterns of firms such as the Baldwin Locomotive Works of Philadelphia, with little or no modification. Each English railway, on the other hand, almost invariably insists on

having distinct designs for itself, so that two engines of the same capacity and general dimensions for different companies may differ widely in small details and fittings, which cost money, but do not, it is to be feared, always bring in a proportionate gain in efficiency.

In addition to being responsible for the building of new engines and the rebuilding of old ones, the locomotive superintendent is the head of the department that actually runs them, and as such has under him a large organisation engaged in seeing that every train is duly supplied with the locomotive power it needs, that the engines are stationed where they can be most advantageously utilised, that they are kept in good working order, and that they are properly equipped with drivers and firemen, and provided with water, coal, oil, and other requisites. On a big line he is aided by one or more assistant superintendents, and a staff of divisional officers or district superintendents placed at important centres where large numbers of locomotives are housed. These subordinate officials are responsible for the details of the administration and discipline of their districts—as, for example, the order in which the engines are taken out, their effective performance, and the arrangement of the hours worked by their drivers and by the army of cleaners, "steam-risers," fitters, and others employed in and around a locomotive shed. Further, they have to draw up periodical reports as to the mileage run by each engine, the repairs executed upon it, the amount of coal it has consumed, the stores used, the wages paid, etc., thus keeping the chief locomotive superin-

tendent informed of what is being done in his department in every part of the line, and enabling him to judge whether or not the work is being performed efficiently and economically. These local officers are also responsible for getting the line cleared if traffic has been blocked by some accident; and for this purpose special breakdown trains are kept at convenient points, equipped with a crane and other necessary appliances, and ready to proceed at the shortest notice to places where their services are required.

The Carriage and Wagon Department, as already mentioned, is often under the charge of the locomotive engineer, but on the larger lines the tendency is to put it under separate control. But, whether it is combined with or independent of the Locomotive Department, its chief is responsible for all the rolling stock—passenger and goods—owned by his company. In concert with the Traffic Department he determines what shall be the character of any new stock that may be required, and, having prepared the designs, he has to see that they are properly carried out—whether, as is often the case, the company undertakes the construction of rolling stock at its own works, or whether it relies upon an outside firm. When the vehicles are delivered and put into use, he has to keep them in order. To that end he has a large staff scattered all over the line at the principal stations—examiners, who see that the running parts of the carriages are in good repair; greasers, who oil or grease the axle-boxes; washers, who wash the outside of the passenger carriages; and cleaners, who brush out and dust their interiors. Goods wagons are examined no less than

passenger coaches; and whether they belong to the company which owns the line, or to a foreign company, or to a private owner, the discovery of defects, not necessarily very serious ones, may lead to their detention until the failing has been put right.

CHAPTER V

SOURCES OF REVENUE

Miscellaneous Receipts—Docks and Steamboats—Passenger and Goods Traffic—Receipts from Passengers—Receipts from Goods—Density of Traffic—Train-Mile Receipts.

THE two chief branches of a railway company's business are the transportation by rail, (1) of passengers, (2) of goods. In addition, it may undertake, as auxiliary to its main business, (3) the transportation of passengers and goods by water, to that end owning and working canals, harbours, docks, and steamboats; and (4) it may do certain other things which are not strictly part of its functions as a purveyor of transportation, such as keeping hotels, and letting houses and lands of which it is the owner, but which it does not require at the time for the immediate purposes of its undertaking.

The third and fourth of these branches do not call for much notice, for several reasons. They are not a part of railway business proper; they contribute directly only a small proportion to the gross receipts, and, so far as steamboats are concerned, perhaps still less to the net profits, and the figures relating to them are compiled and published in a manner that gives as

little information about them as possible. According to the Board of Trade Returns, English railways in 1901 obtained from "miscellaneous rents, tolls, hotels, etc.," about one thirty-first of their total gross income, Scotch railways about one twenty-sixth, and Irish railways about one thirty-second. From "steamboats, canals, harbours, docks, etc.," the receipts of English railways were about one twenty-seventh of the total, of Scotch ones about one seventieth, and of Irish ones about one two hundred and sixty-fourth. The interest of the railway companies in steamboats, docks, etc., is, however, greater than these figures might suggest. For one thing, they do not include the receipts which the London and North-Western derives from the important steamboat traffic it carries on between Holyhead and Ireland, because that company lumps its steamboat receipts with those from its railway traffic, and is therefore unable to supply a separate return of them, as required by the Regulation of Railways Act, 1871, and by the Board of Trade under the Railway and Canal Traffic Act, 1888. For another, it is possible for a railway company nominally to own no ships, and yet in reality to have the control of a considerable fleet, by the simple device of working in combination with, or even promoting, a subsidiary steamship or harbour company, the receipts and expenses of which may not then make their appearance in the railway returns.

Among the big trunk lines of this country, the most important owner of docks and steamboats is probably the London and South-Western, which derives from them about one-eleventh of its gross receipts.

That company in 1892 bought up the Southampton Docks, which it has been energetically developing ever since, and from which it maintains with its own steamers a regular service with the Channel Islands, Havre, Cherbourg, and St. Malo. Its neighbour and rival, the Great Western, runs steamers between Weymouth and the Channel Islands, and of late years has been paying special attention to its Irish traffic by means of steamers from New Milford to Waterford and Cork. It also owns the docks at Plymouth and various other places. The London and North-Western employs a large fleet in the cross-channel trade with Ireland from Holyhead; in addition, it maintains a service, jointly with the Lancashire and Yorkshire, between Fleetwood and Belfast, and as a part owner of the Portpatrick and Wigtownshire Joint Railway it is interested in the Stranraer-Larne route to the north of Ireland. The Midland, so far, has not had much to do with docks and steamers, though it also is interested in the Stranraer-Larne route, and has co-operated with the Furness in regard to steamers from Barrow to Belfast and the Isle of Man. Lately, however, there has been a change in its policy, and it is now constructing a large harbour at Heysham, near Morecambe, from which it has parliamentary powers to run steamers to the Isle of Man and Ireland. The North-Eastern at present owns no steamers, but it has docks at Hull, Hartlepool, Middlesborough, and other places. In addition to possessing, either absolutely or in part, about 170 miles of canals, the Great Central owns extensive docks at Grimsby, whence its own steamers depart regularly for Hamburg, Antwerp, and

Rotterdam; and the same ports are served from Harwich by the Great Eastern, which dispatches its own steamers to the two latter places, the General Steam Navigation Company maintaining the service with Hamburg. The South-Eastern and Chatham has dock accommodation at various points, but its most important marine business is its Continental traffic from Dover to Calais, Folkestone to Boulogne, Dover to Ostend, and Queenborough to Flushing, the boats running in the two latter services being owned by the Belgian and Dutch Governments respectively. It finds a keen competitor in the London, Brighton, and South Coast Company, which runs its own boats from Newhaven to Caen, and is joint owner with the Western Railway of France of those plying between Newhaven and Dieppe.

In Scotland the Caledonian, the Glasgow and South-Western, and the North British are all owners of docks, and are also interested in steamers running from their stations on the coast to watering places down the Firth of Clyde. In Ireland the only two lines that are returned as obtaining any part of their gross receipts from docks, etc., are the Midland Great Western and the Cork, Blackrock, and Passage. In Wales there are two companies which obtain the bulk of their revenue from docks—the Alexandra (Newport and South Wales) Docks and Railway, which depends on its docks for about four-fifths of its receipts; and the Cardiff Company, which, with only three miles of railway, gets six-sevenths of its gross receipts from docks. These, however, though they figure in the railway returns, are really dock companies happening

to work a few miles of railway, and much the same may be said of the Manchester Ship Canal and Railway. Two other Welsh companies, the Barry and the Taff Vale, which, however, unlike those just mentioned, carry passengers as well as goods, also rely for a large proportion of their receipts on the earnings of their docks.

In some cases the docks and steamboat branch of a railway's business seems to yield a fair profit, while in others it is only worked at a direct loss. For instance, the Great Central returned its receipts in 1901 under the head "Steamboats, canals, harbours, docks, etc.," as £182,518, and its expenses as £153,682; in the same year, the London and South-Western spent £419,011 and received £444,359, and the South-Eastern and Chatham obtained £223,742 for an expenditure of £206,444. In other cases the margin of profit was smaller—as with the Great Eastern, which spent £300,800 and made only £303,027. In others, again, there was apparently an actual loss: the Great Western, for instance, spent £205,929, but received only £127,500; the London, Brighton, and South Coast's expenditure of £147,681 was not balanced by its receipts of £121,087; and the North-Eastern was returned as having received only £166,420 for an outlay of £231,821. It must be remembered, however, that docks and steamboats, even though they may yield no direct profit, or may even be worked at a loss, may yet be of great indirect advantage to a railway, by enabling it to influence the course of traffic, and to secure for its own lines the carriage of over-sea goods that otherwise might travel by a rival route.

To come to the proper business of railways—the transportation of passengers and goods. Under the receipts from passenger traffic are included not only the fares received from passengers, whether they hold ordinary, season, or excursion tickets, but also the money received for the conveyance of excess luggage, parcels, horses, dogs, mails, etc.; in fact, everything that is carried in passenger trains, or, in railway parlance, "coaching traffic." Goods traffic receipts, on the other hand, include the amounts received for the transportation not only of general merchandise, but also of live stock and of minerals.

There is considerable difference in the relative importance of these two sources of revenue in different localities. In the United Kingdom generally, on the average of the ten years 1892–1901, passenger traffic yielded 46·1 per cent. of the gross traffic receipts, and goods traffic 53·9 per cent. In England and Wales alone the proportions were not substantially different, being 46·4 for passenger traffic and 53·6 for goods. In Scotland, passenger trains yielded only 41·9 per cent. of the total, the remaining 58·1 per cent. being supplied by goods trains, while in Ireland the passenger traffic took the lead with 54·0 per cent., and goods traffic dwindled to 46·0 per cent. But even greater differences may be found among individual lines in the different countries. For instance, in England the Midland, serving large industrial districts and carrying enormous quantities of goods and minerals, gets in receipts from goods traffic more than twice what it gets from passenger trains, and the same is true of the Great Central. On the North-Western there is a

nearer approach to equality between the two sources of revenue, though the goods traffic is still ahead, yielding about 55 per cent. of the total traffic receipts, and on the Great Western the two are still more nearly equal. But the position is reversed on the southern lines that run through practically no industrial regions at all: thus, on the London and South-Western the goods traffic accounts for less than a third of the whole, and on the London, Brighton, and South Coast and the South-Eastern and Chatham for only about one quarter. In Scotland the same sort of thing may be noticed: the North British, the Caledonian, and the Glasgow and South-Western, all get more from their goods than from their passenger trains, but the passenger receipts of the Highland are not far short of double what it gets from goods traffic. In Ireland the Midland Great Western is an exception to the general rule of Irish railways, and receives more from its goods than from its passengers.

As regards the gross receipts from passenger trains, English railways in 1901 derived only about 16 per cent. from excess luggage, parcels, horses, mails, etc. Of the remaining 84 per cent., roughly 7 per cent. was from first-class passengers, 7 per cent. from second-class, 62 per cent. from third-class, and 8 per cent. from season and periodical tickets. Here, again, individual lines offer some striking contrasts. The Midland received about 6 per cent. from first-class passengers, slightly more from season tickets, and about 66 per cent. from third-class; while the South-Eastern and Chatham, with a gross income from passenger traffic only about half a million sterling

less, received about 12 per cent. from first-class, 13 per cent. from second-class, 52 per cent. from third-class, and 11 per cent. from season tickets. To its neighbour, the London, Brighton, and South Coast, first-class passengers contributed 10 per cent., second-class 12 per cent., third-class 50 per cent., and season tickets 12 per cent.; while the Great Western received 5½ per cent. from its first-class passengers, 11½ per cent. from its second-class, 60 per cent. from its third-class, but only 3 per cent. from season tickets. In Scotland, the railways obtained over 18 per cent. of their gross passenger receipts from parcels, mails, etc., over 8 per cent. from first-class travellers, over 65 from third-class, and about 7 from season tickets. In Ireland, mails and parcels yielded over 22 per cent., first-class passengers 8 per cent., second-class nearly 12 per cent., third-class about 54 per cent., and season tickets 3½ per cent. of the gross passenger traffic receipts.

In regard to receipts from goods traffic, taking English and Welsh railways as a whole and judging from the results attained in 1901, about 56 per cent. of the total comes from the carriage of general merchandise, about 2 per cent. from live stock, and about 42 per cent. from minerals. If the lines are examined individually, some cases will be found among the smaller companies in which minerals are a more important source of revenue than goods and live stock combined: for instance, the Barry gets 92 per cent. of its goods traffic receipts from minerals, the Taff Vale 86 per cent., and the Furness 63 per cent. But among the big trunk systems there is none which

is in this position. The nearest approach to it is made by the Great Western and North-Eastern, both of which rely on minerals for over 49 per cent. of their gross goods traffic receipts. The Great Central follows with 47 per cent. Then there is a drop to the Midland with 41 per cent.; and, considering how regularly and justly that line is referred to as a huge carrier of minerals, it is rather surprising to find that the same percentage is reached by the London and Brighton, which no one ever speaks of as carrying minerals at all. The next lines are the Lancashire and Yorkshire with 37 per cent., the London and North-Western with 36 per cent., and the Great Northern and the South-Eastern and Chatham with 35 per cent.; while lowest of all come the London and South-Western with 30 per cent. and the Great Eastern with 25 per cent.

In Scotland the two largest companies obtain more than half their gross goods receipts from minerals, the proportion being over 50 per cent. in the case of the Caledonian, and over 51 in that of the North British. The Glasgow and South-Western also depends on minerals for a large amount—nearly 44 per cent.—of its goods receipts; but for the remaining two independent systems—the Great North of Scotland and the Highland, both of which run through country which is purely agricultural except where it is moorland or mountain—the proportion falls to about 23 and 15 per cent. For all the Scotch railways together the proportion is between 47 and 48 per cent.

In Ireland generally the mineral traffic is comparatively unimportant, averaging only 12 per cent. of

the total goods traffic. In Ulster two of the lines, the Great Northern of Ireland and the Belfast and Northern Counties, manage to improve on this average with over 14 and over 20 respectively, while the Dublin, Wicklow, and Wexford just passes it. The largest railway in Ireland, the Great Southern and Western, does not succeed in quite reaching it, while the second largest, the Midland Great Western, ascribes less than 5 per cent. of its income to minerals. In Ireland, as might be expected, live-stock traffic is a more important factor than in England or Scotland, contributing on an average over all the railways about 16 per cent. of the gross goods receipts. In this respect the Ulster railways show rather badly, the proportion in the case of the Belfast and Northern Counties falling to about 3 per cent., which is the average for Scotland. For the Great Southern and Western, however, it is 19 per cent., and for the Midland Great Western nearly 27 per cent.

The amount of traffic carried over a given length of line in a given time—in other words, its density—is an item which naturally varies enormously, not only in different parts of the country, but also in different parts of a single railway company's system: thus no one would expect the traffic over a branch line, say, that from Bletchley to Oxford, to be anything like so heavy as on the London and North-Western's main line between Bletchley and London. Details of the traffic on the different lines that are owned by one company are, however, not published—it may be doubted whether they always exist even in the pigeon-holes of the administrative offices—so that no more can be

done than to compare the density of the traffic carried by the different companies as wholes. One way of expressing this density is to divide the gross receipts by the number of miles of line open, the result being the average gross yield per mile. In dealing with figures for different companies obtained in this way, it should be remembered that any comparison between them, to be quite fair, involves the condition, among others, that the rates charged shall be exactly equal for equal service—a condition which does not hold in practice. Moreover, the unit employed—mile of line open—is not a definite, fixed quantity, since it includes without distinction railways which consist of a single line just as much as those which have two, three, four, or even six tracks. Yet the carrying capacity (for traffic in both directions) of a double line is obviously more than twice as great as that of a single line, and what would be very heavy traffic for the latter would be only moderate for the former.

On the average of all the railways in the United Kingdom the gross receipts from traffic—passenger and goods—per geographical mile of line open in 1901, amounted to £4511. Except that £4523 was realised per mile in 1900, and £4607 in 1902, this figure is the highest yet reached; and apart from occasional relapses, due no doubt to fluctuations in trade, there has been a steady increase for the last half century. Up to and including 1870 the amount never reached £3000 per mile, but in that year it amounted to £3064, and in 1896 it passed £4000. The average for England and Wales alone in 1901 was £5520; for Scotland, £3198; and for Ireland,

£1154. In individual cases these amounts are, of course, greatly exceeded; in others they are not nearly attained. The largest receipts per mile are to be found in suburban or metropolitan lines, which carry a heavy passenger traffic undiluted with long-distance travellers. The Central London, for instance, collected over £50,000 per mile, and the Metropolitan District nearly £20,000, while the Metropolitan, in spite of a long country extension, obtained from passengers alone over £9300. Among the big English systems the Lancashire and Yorkshire was easily first with £9497 from passengers and goods combined. From the former it obtained £4163 per mile, a figure which is only surpassed by the London and Brighton with £5103, and the South-Eastern and Chatham with £5096. Its receipts from goods traffic, £5334, also headed the list among the large lines, though the Midland ran it close with £5173. The next as regards goods receipts was the Great Central with £4196 per mile, followed by the London and North-Western (£3921), the Great Northern (£3596), the North-Eastern (£3527), the Great Western (£2168), and the Great Eastern (£2009). In regard to passengers, after the lines already mentioned came the London and South-Western with £3357, the London and North-Western with £3130, the Great Eastern with £2769, the Great Northern with £2605, the Midland with £2517, the Great Western with £2009, the Great Central with £1879, and the North-Eastern with £1823.

The traffic densities for different lines may, however, be compared together on somewhat more equal

terms by taking as the unit, not the geographical mile of railway, but the mile of single track, obtained by multiplying the number of geographical miles of line by two, three, or four, according as the way is double, triple, or quadruple. (See p. 16.) Calculated in this manner, the average receipts per mile of single track in the United Kingdom in 1901 were £2764, of which goods yielded £1470, and passengers £1294. As regards passenger traffic, the London and Brighton and the South-Eastern and Chatham again took the lead each with more than twice the average; the Lancashire and Yorkshire followed with £2123, the London and South-Western with £1899, the Great Eastern with £1699, the North-Western with £1555, the Great Western with £1267, the Midland with £1227, the Great Northern with £1212, the North-Eastern with £1038, and the Great Central with £929. In goods traffic the Lancashire and Yorkshire still led with £2720; after it came the Midland (£2521), the Great Central (£2075), the North-Eastern (£2008), the North-Western (£1948), the Great Northern (£1674), the Great Western (£1368), the Great Eastern (£1233), the London and Brighton (£947), the South-Eastern and Chatham (£907), and the London and South-Western (£852).

In Scotland the railways enjoy a much less dense traffic than in England. The Caledonian, which obtains the best results, in 1901 got £1923 from passenger trains and £2592 from goods trains per geographical mile (£1224 and £1650 per mile of single track), and it was followed by the Glasgow and South-Western with £1893 from passengers and

£2025 from goods (£1083 and £1302 per mile of single track). The North British obtained £1336 and £1976 per mile from passenger and goods trains respectively (£952 and £1406 per mile of track); while the Highland, running through districts where population is sparse and manufactures practically non-existent, made only £681 per mile from its passenger trains and £362 from its goods trains (£642 and £342 per mile of single line). In Ireland the gross earnings per mile are still less than in Scotland. Of the three largest lines, the Great Northern of Ireland does best. In 1901 its gross receipts per mile from passenger trains were £925, and from goods £764 (per mile of single track £729 and £603). The Great Southern and Western came next with £598 and £568 respectively (£489 and £464 per mile of single track); and the third, the Midland Great Western, with £486 and £545 (per mile of single track £374 and £419), showed even poorer results than the Highland in Scotland.

The table on the next page shows the amounts received by the eighteen largest companies, from passenger and goods traffic combined, per geographical mile and per mile of single track of railway open at the end of 1901, similar figures for 1891 being appended for comparison. It may be added that in 1901 the gross traffic receipts per mile of single track were, in the United Kingdom, £2764; in England and Wales, £3110; in Scotland, £2264; and in Ireland, £965.

A rough measure of the amount of work done in order to earn these sums is afforded by what may be called the expenditure of train-power, or the number

of train-miles run in proportion to the miles of railway in use. In the United Kingdom, as a whole, about 11,060 train-miles a year are run for each mile of single track—in England, about 12,235 miles; in Scotland, about 9649; and in Ireland, only 4595. The miles

	1901.		1891.	
	Geographical Mile.	Mile of Single Track.	Geographical Mile.	Mile of Single Track.
	£	£	£	£
Lancashire and Yorkshire	9497	4844	8334	4256
Midland	7690	3748	6564	3404
London and North-Western	7051	3503	6127	3107
South-Eastern and Chatham	6875	3507	5794	2971
London, Brighton, and South Coast	6856	3696	5588	3188
Great Northern	6201	2886	4965	2612
Great Central	6076	3004	6309	3073
North-Eastern	5350	3046	4341	2603
London and South-Western	4866	2751	3960	2518
Great Eastern	4778	2932	3561	2287
Caledonian	4515	2874	3684	2429
Great Western	4177	2635	3529	2367
Glasgow and South-Western	3918	2385	3434	1940
North British	3312	2358	2897	2011
Great Northern of Ireland	1689	1332	1399	1105
Great Southern and Western	1166	953	1449	1061
Highland	1043	984	1061	1035
Midland Great Western	1031	793	1162	853

travelled by passenger trains everywhere predominate, forming about 55 per cent. of the total in England and Wales, over 56 per cent. in Scotland, and nearly 67 per cent. in Ireland. In the last-named country between 6 and 7 per cent. of the train-mileage is due to "mixed" trains conveying both passengers and

merchandise; but in England and Wales such mileage amounts to only a fraction per cent., and in Scotland it has been completely discontinued since 1895.

The greatest expenditure of train-power is to be found in lines like the Central London or the Liverpool Overhead, which are purely passenger lines running through densely populated districts: the train-mileage of the former per mile of single track is over 100,000 a year, and of the latter over 60,000. But none of the big lines doing an ordinary business in carrying passengers and merchandise comes anywhere near these figures. The top place is occupied by the Lancashire and Yorkshire and the Midland, both of which run between 16,000 and 17,000 trains per mile of single track per annum. The former company in 1901 had 11,286 passenger train-miles, the highest figure among the big lines, though it was followed pretty closely by the London and Brighton with 10,313, and by the South-Eastern and Chatham with 9092. Then came the London and South-Western and the Great Eastern with 8092 and 7166 respectively, while for the rest of the important English and Scotch lines the amount was mostly in the neighbourhood of 6000. The Highland fell to about 3230, which was not far below the figure of the Great Northern of Ireland (3596), and a good deal above that of the Great Southern and Western (2731), or the Midland Great Western (2264). In regard to goods trains, the Midland was easily first with 9530 train-miles per mile of single track, the Great Central took second place with 7763, and the Great Northern followed with 6309. The North-Western, North-

Eastern, Great Western, and Lancashire and Yorkshire were all fairly near the English average (5394); while the Caledonian, North British, and Glasgow and South-Western were all above the Scotch average (4207), which was kept down by lines like the Highland with 2024, or the Portpatrick and Wigtownshire Joint with 1707. Of the Irish lines the Midland Great Western was exactly equal to the Irish average (1401), but the Great Southern and Western reached 1645, and the Great Northern 1789. Further details are given in the accompanying table.

The division of the train-mileage into the gross receipts from traffic yields a figure which represents the average receipts obtained from each train for each mile it runs. This varies widely in different parts of the country and on different lines. The average for the United Kingdom, for passengers and goods traffic combined, has never since 1854 been more than 5s. 11¼d., and never less than 4s. 9¼d. The figure reached its maximum in 1856, and from that year it steadily shrank till 1865, when it was 5s. 1¾d. In 1866 there was a recovery to 5s. 4d., followed by a fall till 1870, when the average was 5s. 1½d. During the next few years there was a gradual rise till 1874, when 5s. 8d. was realised, but another relapse then set in and steadily continued, with one slight break in 1882, until 1885, when the figure for the first time fell below 5s., an average which was not again attained till 1901. The minimum of 4s. 9¼d. was recorded in 1893, but 1892, 1894, and 1898 were very little better with 4s. 9½d. The receipts have usually been about one penny per train-mile higher in England and

		Gross Traffic Receipts per Mile of Single Track.	Train-Miles per Mile of Single Track.	Receipts per Train-Mile.
		£		d.
Great Western	Pass.	1267	5,652	53·83
	Goods	1368	5,308	61·86
London and North-Western	Pass.	1555	6,838	54·59
	Goods	1948	5,460	85·65
Midland	Pass.	1227	6,733	43·75
	Goods	2521	9,530	63·52
North-Eastern	Pass.	1038	5,296	47·03
	Goods	2008	5,577	86·44
North British	Pass.	952	5,060	45·12
	Goods	1406	4,782	70·60
Great Eastern	Pass.	1679	7,166	56·91
	Goods	1233	4,844	61·09
Great Northern	Pass.	1212	6,738	43·19
	Goods	1674	6,309	63·70
London and South-Western	Pass.	1899	8,092	56·34
	Goods	852	2,963	68·99
Caledonian	Pass.	1224	6,352	46·28
	Goods	1650	4,963	79·82
Great Southern and Western (Ireland)	Pass.	489	2,731	42·96
	Goods	464	1,645	67·68
South-Eastern and Chatham	Pass.	2600	9,092	68·64
	Goods	907	2,776	78·47
Lancashire and Yorkshire	Pass.	2123	11,286	45·15
	Goods	2720	5,486	119·00
Great Central	Pass.	929	5,868	38·01
	Goods	2075	7,763	64·15
London, Brighton, and South Coast	Pass.	2751	10,313	64·03
	Goods	945	2,403	94·42
Glasgow and South-Western	Pass.	1083	5,833	44·58
	Goods	1302	4,315	72·42
Midland Great Western	Pass.	374	2,264	39·68
	Goods	419	1,401	71·79
Great Northern (Ireland)	Pass.	729	3,596	48·66
	Goods	603	1,789	80·83
Highland	Pass.	642	3,230	46·72
	Goods	342	2,024	40·49
England and Wales	Pass.	1458	6,841	50·86
	Goods	1652	5,394	73·41
Scotland	Pass.	996	5,442	43·95
	Goods	1267	4,207	72·30
Ireland	Pass.	523	2,843*	42·71
	Goods	442	1,401*	72·44
United Kingdom	Pass.	1294	6,217†	49·61
	Goods	1469	4,802†	73·25

* In addition, there were 351 miles of mixed trains.
† In addition, there were 41 miles of mixed trains.

Wales than in the United Kingdom generally, while on the average during the twenty years, 1882–1901, they have been about 5d. per train-mile lower in Scotland and about 5½d. lower in Ireland, where, however, the difference has of late years been rather greater, amounting to 7d. in 1899 and to 9¼d. in 1901.

From passenger traffic alone the receipts for the same twenty years in the United Kingdom, England and Wales, Scotland and Ireland respectively, averaged 4s. 0¾d., 4s. 2d., 3s. 6d., and 3s. 8d. per passenger train-mile, and from goods traffic alone 5s. 10¼d., 5s. 10½d., 5s. 6½d., and 6s. 4½d. per goods train-mile. The comparison of these averages with the amount realised in 1901 indicates that in Ireland the train-mile is less profitable than it used to be by over 11¼d. in the case of passenger traffic, and by 4d. in that of goods traffic, but that in Great Britain it brings in rather more. The largest increase was in Scotland, where in 1901 the receipts per passenger train-mile were more than 1¾d. better than the twenty-year average, and per goods train-mile had improved by 4¼d. In England and Wales the receipts from passengers had in the same year improved by 1d. per train-mile, and those from goods by 3¼d. The average increase for the United Kingdom was 1d. for passenger traffic and 3d. for goods.

English railways present many contrasts in the amounts of their receipts per train-mile from passengers and goods. The line which in 1901 got the smallest return (3s. 2d.) from its passenger traffic was the Great Central, in connection with which, however, it must be remembered that it is burdened with its new

extension to London, on which, to develop traffic, more trains, probably, are run than are really required to accommodate the present number of passengers. Two other heavy goods lines came next in the shape of the Great Northern and the Midland, both with between 3s. 7d. and 3s. 8d. per passenger train-mile, and close upon them were the Lancashire and Yorkshire and the North-Eastern with 3s. 9d. and 3s. 11d. The London and North-Western, which derived 4s. 6½d. from passengers and 7s. 1½d. from goods per train-mile, was one of the few companies that succeeded in passing the English average in both departments, the only other lines that did so being the London and Brighton and the South-Eastern and Chatham with 5s. 4d. and 5s. 8½d. a train-mile respectively from passengers, and 7s. 10½d. and 6s. 8½d. from goods. The London and Brighton's figure for goods traffic, indeed, was the best attained by any of the railways under consideration, with the exception of the Lancashire and Yorkshire, which reached 9s. 11d. Even the North-Eastern was behind it with 7s. 2½d., and important mineral lines like the Great Western, the Midland, the Great Northern, and the Great Central did not reach 5s. 6d.

In Scotland there was not much difference between the three largest companies, the Caledonian achieving the best results with 3s. 10¼d. from passenger trains and 6s. 7¾d. from goods trains, though the Highland's passenger record was nearly a halfpenny better. In Ireland the Great Northern obtained over 4s. 0½d. for passengers and 6s. 8¾d. for goods. The Great Southern and Western and the Midland Great Western did

not do so well, the former's figures being 3s. 7d. and 6s. 7¾d., and the latter's 3s. 3¾d. and 5s. 11¾d., for goods and passengers respectively.

At first sight it might appear that train-mile statistics should afford a useful criterion for judging whether a line is being economically managed or not. That there should be large differences in the gross receipts per mile of railway open, is, it might be argued, only natural, considering the differences in the population and industrial resources of the regions served by different companies. Train-mile earnings, however, might seem to stand on a different footing. When the London and Brighton is seen to get an average of over 5s. for every mile travelled by each of its passenger trains, whereas the Great Northern only gets 3s. 9d. and the Great Central 3s. 2d., or when a goods train yields the Lancashire and Yorkshire 10s. for every mile of its course (in the first half of 1903 the amount was 10s. 8½d.), but the North-Western only 7s. and the Midland little more than 5s., it might be supposed that there must be something else than divergencies in natural conditions to account for the lack of uniformity, and that fundamental differences in methods of management must be assumed. To a certain extent such differences doubtless exist, and every line is not administered with equal skill and efficiency. At the same time, these differences cannot be safely inferred simply from differences in the receipts per train-mile, any more than want of economy can properly be attributed to one company as compared with another, merely on the ground that its working expenses absorb a larger proportion of its gross revenue.

Train-mile statistics alone are insufficient to support any allegation of inefficient management, and much more must be known about the circumstances in which a line has to work and the character of the traffic with which it has to deal, before trustworthy conclusions can be drawn regarding the economy with which its affairs are conducted.

CHAPTER VI

TRAIN-MILES AND TON-MILES

Train-Mile Statistics—Their Deficiencies—Passenger-Miles and Ton-Miles—Advantages claimed for them—Do they afford a Test of Economical Working?—Impossibility of separating Passenger Expenses from Goods Expenses—Imperfections of the Ton-Mile as a Unit—Meagreness of British Railway Statistics.

In Great Britain the geographical mile of line open for traffic and the train-mile are generally used as the fundamental units in railway statistics, and are employed not only in the returns and reports published annually by the Board of Trade, but also in the half-yearly reports of the different railway companies. The former unit, as has already been remarked, is imperfect for some purposes, inasmuch as it treats all railways as equal, whether they consist of one, two, or more sets of rails, and it has further been pointed out that some improvement can be effected by reducing each mile of double, triple, or quadruple line to its equivalent length of single track and employing the mile of single track as the unit. Even so, however, complete uniformity is not attained, because a single line on which trains run in both directions obviously cannot hold as many trains as a single set of rails, with block sections of

the same length, used for trains travelling all in the same direction.

The second unit—the train-mile—is still more indefinite. The train-mileage of a railway is got by multiplying the number of trains run by the number of miles over which they have travelled. Here the mile is definite enough as a distance (though it makes a good deal of difference to an engine with a heavy train behind it, whether the particular mile of line is straight and level or curved and hilly); but the train, in regard to any discussion of the economics of transportation, is not a definite quantity at all. An engine hauling a single carriage with half a dozen passengers is just as much a train as one with twenty carriages packed with a thousand passengers, and every mile that each of them runs adds an equal increment to the train-mileage record. Yet the amount of transportation yielded by the latter is as important as that from the former is insignificant, and the one is making a handsome profit while the other is running at a dead loss. A railway manager who, in the absence of compelling circumstances, ran many trains of the former sort, would properly be regarded as an extravagant person; and, all other things being equal, his extravagance would be indicated by the train-mile receipts of his line when compared with those of another on which larger loads were the rule.

All the other things, however, are very far from being equal. Even in regard to size and loading of trains, it is quite impossible in practice for every railway to fill its trains with the same number of people. One line may, at times, have more passengers

than it knows how to accommodate, while another may always have so few that, if its trains were never dispatched until they were full, none would ever start at all. But supposing that full train-loads were universal and were physically equal on every line, inequalities in receipts per train-mile would still inevitably exist, because there are different classes of passengers and of goods, each of which pays different amounts for being conveyed over the same distance. Since a first-class passenger, for example, pays roughly twice as much per mile as one travelling third-class, a given number of first-class passengers brings in twice as much money to the railway as the same number of third-class travellers; and the higher the proportion of first-class to third-class passengers, the higher are the receipts per train-mile from an equal number of persons travelling equal distances. As a matter of fact, this proportion, which is a thing over which the management has little or no control, does vary greatly on different lines and in different parts of the country, and corresponding variations in receipts per train-mile are only what is to be expected from this cause alone.

With merchandise traffic the number of classes paying different rates is still greater. As will be seen subsequently (Chap. X.), ordinary merchandise is divided into eight classes, for each of which there is a different scale, and there are in addition separate scales for live stock, carriages, parcels, etc. Moreover, the charges per mile which railways are authorised to make for conveying goods vary according to the distance, getting progressively smaller per ton as the distance becomes greater; hence the average length

of haul, that is, the number of miles over which the goods are conveyed, is another factor which should be taken into consideration in any attempt to form an opinion as to the economy, or want of economy, shown in the management of a particular railway.

The ton-mile and the passenger-mile are units which in some respects show a considerable improvement over the train-mile. The passenger-mile is used to combine the number of passengers with the distance they travel: thus a train running 100 miles with a hundred passengers gives rise to 10,000 passenger-miles, and would do the same if it ran 10,000 miles with one passenger, or 10 miles with a thousand passengers. Similarly, the ton-mile combines the weight of the goods handled with the distance they are conveyed. Ton-miles and passenger-miles (or tons one mile and passengers one mile, as they are sometimes expressed) thus give content to the train-miles. Anyone who knows the train-mileage and the gross receipts of a railway can calculate how much on an average was received from each train per mile, and, by comparison with the same figures for other periods, he can learn whether the trains have been run more or less profitably; but he gets no definite measure of the amount of transportation effected by them, *i.e.*, the average weight of goods or number of passengers carried. If, however, he is in possession of the figures of the passenger-mileage, he can, by dividing them by the passenger train-mileage, discover the average number of passengers in the passenger trains, and similarly, by using the goods train-mileage, he can find the average weight of the goods in the goods trains. Further, these figures

give a clue to that important quantity, the average length of haul: this is obtained, for goods and passengers respectively, by dividing the ton-mileage by the tons of goods handled, and the passenger-mileage by the number of passengers. It may be noted that, in the passenger-mileage, a disturbing element is introduced by the existence of season tickets which allow their holders to make an unlimited number of journeys for the money they have paid. How many journeys they actually do make must necessarily be a matter of estimation only, not of accurate counting, and to that extent the totals of the passengers carried must be inexact. In the British statistics, the simple, but not very satisfactory, expedient is adopted of omitting season-ticket holders altogether from the totals of passengers.

In England many of the railways formerly prepared statistics of passenger- and ton-miles, but the practice was abandoned because the cost of compiling them was thought to be excessive in comparison with the usefulness of the result to the officials of the lines. In America they are almost universal, and, in the opinion of some observers, have contributed largely to the excellent results achieved of late years by American railway administration. It may be remarked, however, that the elaborate statistics which excite the envy of students of railway economics are not all prepared by the American railways of their own free will, but in many cases under the compulsion of the law. The Inter-State Commerce Commission, not to mention some of the State Legislatures, has powers to require the railways to supply certain particulars of their working,

and the increasing demands of that body are by no means always received with cheerful acquiescence. This fact raises the presumption that all the particulars which are now available respecting the earnings and expenses of the railways are not considered absolutely necessary for efficient operation by the railroad officials themselves; and this presumption is not weakened by the circumstance that the United States Government is known to be proud of the fulness of its industrial statistics, and in regard to them is determined to maintain the reputation it has already achieved.

In this connection some remarks by President Hadley of Yale are of interest. He says (*Railroad Transportation*, pp. 156, 157): "There is a fundamental difference of purpose between train-mile and ton-mile statistics. The train-mile is, in a rough way, the unit of railroad service—so much work done by the railroad. The ton-mile (or passenger-mile) is, in the same rough way, the unit of public service—work done for the public. Now, the whole theory of the English railroad system starts from the principle that railroads are to be managed as business enterprises, not as matters of public service; hence their impatient rejection of the idea that they should compile a set of statistics arranged from an outside point of view, with but little inside interest."

Not everyone, however, who is anxious for British railways to revive the practice of preparing ton-mile and passenger-mile statistics would subscribe to the suggestion that such figures are of "but little inside interest." On the contrary, a band of reformers has

recently arisen in England who are anxious to get the preparation, if not the publication, of such statistics imposed on the companies, on the ground that no scientific railway management is possible without them. The only company, however, which has as yet declared itself in favour of ton-miles and passenger-miles is the North-Eastern, which in 1901 announced its intention of regularly preparing such figures; but it is believed, though the fact has never been officially stated, that the London and North-Western has been doing something of the kind for several years past.

On the whole, English managers are not convinced that on their lines substantial advantages are to be derived from the employment of ton-mile statistics. They feel that, while American railroads have to deal with big lots of a single commodity, travelling perhaps thousands of miles continuously, English traffic consists of many heterogeneous articles carried in small quantities over short distances, and they question whether an average compounded from scores of miscellaneous items, all differing in weight, bulk, and cost of handling, would be of much help to them in practical administration. Mr. Gibb of the North-Eastern has remarked that, in spite of their dangers and defects, averages cannot be dispensed with, and that "if a business man were heard to say that he did not use any average figures in his business, that remark would probably be taken to indicate a low average of intelligence." But in another connection Mr. Gibb also observed that "the average rate per ton on all traffic carried is a misleading figure. If one is in search of bare truth, one must examine the

component parts of the average." This last remark pretty well expresses the attitude of those persons who do not welcome ton-mile statistics with open arms; they consider that the component parts of the average would be so divergent and varied that the average of itself could be of little or no practical use. The remedy, it may be replied, is to construct the averages properly, to take them out separately for different classes of goods—a course which was in February 1903 rendered obligatory on American railways in respect of *car-load* lots of grain, hay, cotton, coal, lumber, live stock, and dressed meat. But what would be the expense of preparing such detailed figures for all articles conveyed on English railways, and what would be their value, when prepared, as a guide in practice, considering that the actual cost of conveying a ton of one kind of goods a mile must be ever changing according to the quantities of other kinds that happen to be associated with them in the same train?

One of the advantages claimed to follow from the systematic preparation and employment of such figures is that they enable a manager to check the loading of the trains on his line, to compare the results obtained on different sections of it at different times, and in general to secure effective control over its working. In reply, those who regard train-mile statistics as sufficient might ask whether there is any need to go to the expense of preparing ton-mile statistics to make sure that the loading of the trains is as good as possible, and whether the same end cannot be attained by a proper system of inspection. Ton-mile figures cannot,

in fact, supersede such inspection in any event. Being merely averages, they may allow a proportion of trains happening to be very well loaded to mask a number running unnecessarily light, and these may escape notice if the statistics are relied upon to the exclusion of examination. Again, supposing the figures indicate that the standard of loading is low in a particular district, the causes will have to be ascertained by inspection and consideration of particular circumstances. But if the full meaning of ton-mile averages is only to be elicited by the aid of careful inspection, why not save the trouble and expense of preparing them, and aim at perfecting the system of inspection which is indispensable in any case?

Further, if the attainment of a good train-load average is blindly treated as the test of efficiency in a divisional officer, there is a danger that, in his anxiety to show a good result, he may be tempted into taking measures liable to diminish the popularity, and therefore the traffic, of his line. The aim of economical administration is to carry as many passengers and tons of goods in as few trains as possible. But if the loading of the passenger trains is increased till travelling is rendered uncomfortable by overcrowding, or if the number of the trains is reduced till the line gets the reputation of giving a poor service, no real economy is effected; for what is gained on the one side is lost on the other, through passengers transferring their patronage to rival routes managed with more liberality. Similarly with goods traffic: an officer who tried to detain consignments until he could dispatch them in good fat train-loads

that would look well in the statistics of his division, would be likely to find that the inevitable delay in delivery was costing his line more in loss of custom than it was gaining by economy of operation.

In addition to affording indications of the loading of trains, ton-miles and passenger-miles statistics, it is said, enable a manager to learn how much is received on the average for carrying a passenger or a ton of goods one mile, and what is the expense incurred by the railway in so doing. The average receipts per ton-mile or passenger-mile are obtainable by dividing the total ton-mileage or the total passenger-mileage into the gross receipts from goods or passengers. Similarly, the cost of moving a ton of goods or a passenger one mile ought, on the same principle, to be discoverable by dividing the ton-mileage or the passenger-mileage into the gross expenses of conducting the goods traffic or the passenger traffic. Then the manager, knowing both his receipts and his expenses per ton-mile or passenger-mile, deducts the one from the other, and gets a nice little sum that shows him the profit or loss which his line is making on each ton or passenger per mile. One enthusiast has even held out to him the prospect that he will thus be able "to justify, either to the Railway Commissioners or to the customers of the company, any rates which may be made after the cost of carrying the individual article has been considered."

Unfortunately for this alluring prospect, its realisation would require the separation of the expenses involved by the passenger traffic from those involved by the goods traffic, and to effect that separation with

anything like real accuracy is a task which passes the wit of man. It is true that in some American statistics, *e.g.*, those issued by the Board of Railroad Commissioners for the State of New York, the expenses of carrying a ton of freight or a passenger one mile are solemnly set forth, together with the amounts received for the same items and the resultant profits. But it is impossible to feel any confidence that these figures have more than a nodding acquaintance with the actual facts. They are obtained by allocating a certain proportion of the total expenses to passenger traffic and the remainder to goods traffic; but the way in which this allocation is made must be chiefly a matter of individual idiosyncrasy, since there is no ascertainable principle according to which it ought to be made. The worthlessness of figures calculated on such a basis, at least as a measure of absolute cost, is now recognised by scientific statisticians in the United States, and they no longer find any place in the reports of the Inter-State Commerce Commission.

The impossibility of accurately dividing a railway's expenses between its passenger and its goods traffic may easily be seen from the consideration of a few items. There are, of course, some expenses which can be definitely assigned to the two departments: for instance, the salaries of goods-train guards and engine-drivers, the coal, oil, etc., consumed by goods engines, the costs of cartage, loading, etc., incurred at goods yards, all obviously go to the debit of the goods traffic. But signalmen, stationmasters, porters at the smaller stations who are concerned with working both goods and passenger traffic,—in what proportion are their

wages to be divided between the two? The permanent way and signals are used by both. What percentage of the wear and tear and of the cost of maintenance is to be assigned to each? The relative number of trains of each sort might be a fairly just criterion so far as the signals go (though it must be remembered that much less complex and expensive signalling arrangements than are fitted on British railways would be needed if there was no passenger traffic), but would be entirely inadequate in regard to the permanent way and bridges. Each vehicle run contributes to the wear of the rails, but its effect varies according to its weight and the speed at which it is moving. How are these factors to be correctly distributed? The car-mileage (*i.e.*, the product of the number of vehicles employed by the distance they have run) of the vehicles in each department would not be of much use, because of the differences in weights. Even a goods train and a passenger train of equal weight and equal speed probably do not cause equal wear and tear, and more damage may be done to a steel bridge by the lighter but more frequent impacts of the wheels of empty goods wagons than by the heavier but less frequent blows given by the wheels of long bogie passenger coaches. To give a final example out of many more that are available: the expenses of the goods manager's department are fairly charged against the goods traffic; but what is to be done with those of the running department, of the general manager, of the solicitor, of the secretary, of the accountant, whose functions are coextensive with everything the railway does?

The fact is that a railway, unless it happens to carry goods or passengers exclusively, works its goods service and its passenger service as one whole, and the problem of accurately distinguishing the expenses of the two is about as soluble as that of exactly squaring the circle.

But supposing the division to have been accomplished approximately, if not in a mathematical sense, is a knowledge of the average cost of carrying a ton of goods one mile, thus put at the disposal of a railway administrator, of practical use to him in his daily work? Does it, for instance, at once enable him to say with certainty that the traffic on a particular section of the line is being conducted extravagantly, that a certain kind of goods is being carried at a loss, or that another kind can be carried for such and such a rate at a fair profit?

The answer given by Mr. Albert Fink, one of the most distinguished authorities on railway statistics, and moreover an American authority, is as follows:—"A mere knowledge of the average cost per ton-mile of all expenditures during a whole year's operation is of no value whatever in determining the cost of transporting any particular class of freight, as no freight is ever transported under the average condition under which the whole year's business is conducted. We can therefore not make the average cost per ton-mile the basis for a tariff, if it is to be based upon cost; but we must classify the freight according to the conditions affecting cost of transportation, and ascertain the cost of each class separately." Here, again, the "searcher after bare truth" is advised to "examine

the component parts of the average." Carried out to its logical extreme, this advice means that ton-mile costs should be ascertained for every class of traffic, if not for every article—a requirement which would most certainly involve substantial additions to the salary list of the accountant's office, though it might not bring with it any equivalent economy in the working of the railway. In any case, what becomes of the contention that a knowledge of average costs per ton-mile would enable a company to justify increased rates to the Railway Commission? The Great East and West Railway wants to raise its coal rates from A to B (say 20 miles), and tries to justify its action by producing ton-mile statistics showing that over its whole system, 1000 miles in length, the cost of carrying coal has increased 5 per cent. The Railway Commission is not at all likely to grant the Great East and West's demand on such evidence, for it knows that "no freight is ever transported under the average condition under which the whole year's business is conducted," or under which the whole system is worked, and moreover that conceivably the cost of moving coal between A and B has actually diminished, although the average cost all over the railway has increased. If such evidence failed to convince a judicial body like the Railway Commission, still less likely would it be to satisfy an incensed trader complaining of extortionate rates.

To consider ton-miles and passenger-miles from a slightly different point of view, it may be suggested that, as units of railway service, they are not entirely satisfactory in regard to definiteness. The mile

as a distance of 1760 yards is exact enough; but one mile of railway may, and does, differ very widely from another in cost of construction, cost of maintenance, and cost of employment as a means of moving passengers and goods from one place to another. An engine with a certain load behind it finds a mile of Shap incline a very different matter according as it is running up or down; and, similarly, to haul a ton over a mile of corkscrew, such as is to be found on the Midland's line from Derby to Manchester, is to perform a different service from hauling a ton for a mile over the gentle curves of the Great Western between London and Maidenhead. But the ton-mile unit treats a mile as a mile, whether it be uphill or downhill, or straight or crooked, and entirely ignores the fact that, according as these physical conditions vary, a different service is performed by the railway and a different cost incurred.

Again, every passenger is not the same. Not to mention differences of personal weight, the man who travels in a first-class carriage is a different thing from a third-class passenger, in respect to the work done by the railway and its cost, because he is given more space, involves the hauling of more dead weight, and enjoys more expensive fittings. Still more may one ton of goods differ from another: a ton of coal is different from a ton of hay in respect to the space it occupies and the amount of dead weight that has to be hauled in order to convey it, and a ton of iron ore is different from a ton of meat in carcases, not only in regard to the space occupied, but also to the cost of handling. Yet neither the passenger-mile nor the

ton-mile takes any notice of these differences; and they agree further in ignoring another important factor, that of speed, which affects both the cost of the service to the railway and its value to the passenger or trader. The proverb informs us that time is money. If that is so, the man who is taken from London to Glasgow in eight hours receives a more valuable service from the railway than does he who occupies twelve hours on the journey; and, similarly, the shopkeeper who gets delivery of his goods from the manufacturer the day after he posts his order is better off than the man who has to wait a week. Yet 100 tons of goods travelling 300 miles to Carlisle from London would add precisely the same amount to the ton-mileage account, whether they took ten hours or ten days on their journey.

The above remarks are perhaps sufficient to suggest that it is possible to overestimate the value of ton-mile and passenger-mile statistics in the practical administration of British railways, and that British officials, in declining to prepare them, do not necessarily prove themselves ignorant of their business or careless of the interests committed to their charge. Such figures are important to a manager only so far as they enable him to get at certain information respecting the conditions under which the business of his line is conducted; and, though in America they may afford the cheapest and most convenient method by which the desired end can be attained, it does not follow that in England, where the railways have to work in totally different circumstances, other methods may not be quite as effectual while less expensive.

It seems probable, indeed, that there are American railroad managers who, if they were put at the head of an English company, would not pay much attention to figures of ton-mileage. Mr. G. E. Childs, general manager of the New York, Ontario, and Western Railway Company, is reported to have said: "Unfortunately, the roads in this country have not yet agreed upon standard methods of compiling statistics of ton-mileage. I think the best result for comparison can be attained by eliminating, as far as practical, all the small matters which vary according to local conditions on each line, and taking the tonnage of through merchandise and mineral trains only. . . . I find also that the statistics are much more valuable when applied to through freight, coal or merchandise trains, omitting the way-freight or peddling trains. These trains we must run on schedule daily for the accommodation of the public, and it is not practicable at all times to rate tonnage according to the capacity of the engine. Many of the cars in these trains are run light, with less than car-load lots. For these reasons I make separate reports of way-freight trains, and omit all the locals in arriving at the ton-mile unit." Now, if Mr. Childs came over here he would find that practically all our railway traffic is "peddling" when judged by American standards, and that nearly all our trains must "run on schedule for the accommodation of the public." Is it not, therefore, a fair inference that he would fail to find any extraordinary virtue in ton-mile statistics for the purposes of English railways?

With regard to the question of railway statistics in

general, not for the special use of the railway official but for the information of the public at large,—when the student of railway economics thinks of the meagreness and obscurity of the statistics put at his disposal by the Board of Trade, and then contemplates the wealth of detail available for almost every country but his own, he may well be filled with envy. For America, Germany, France, etc., he can get the fullest information about every line from every point of view. In England, on the other hand, it is difficult to find an authentic statement even of such a simple matter as the distance between two stations, and there is an entire absence of many particulars—for instance, the length of sidings possessed by the different companies, the engine miles run, the proportion of engine power expended in shunting, etc.—which are essential to an intelligent understanding of the operations of a railway.

Still it would be as unfair to blame the railway companies for this state of things as it is gratuitous to suppose, as some critics apparently do, that the statistical apparatus prepared by them for their own use is not more complete and informing than the figures required and published by the Board of Trade. As has already been remarked, in this country the railway companies have mostly been looked upon as private trading concerns, into whose affairs the public has no more right to pry than it has to call for the books of any private citizen. In America, the State, recognising in the railroads the most important factor in the industrial development of the country, has taken the view that full accounts of everything they do are

desirable in the interests of public policy, and has therefore ordered the publication of particulars, statistical and other, which there is little reason to doubt would not have been published, in many cases probably not even prepared, except for this State compulsion. The American view of the matter, however, is gradually gaining ground in this country, and the demand for fuller and better statistics, augmented as it is by the voices of railway shareholders who are discontented with their dividends and have a fancy to see for themselves more exactly what is done with their money, may in time become strong enough to induce the Board of Trade to act. That department, it may be noted, has ample powers for the purpose, if it would but exercise them, since the Railway and Canal Traffic Act of 1888 enacts that "the returns required of a railway company under section 9 of the Railway Regulation Act, 1871, shall include such statements as the Board of Trade may from time to time prescribe, and the forms referred to in that section may from time to time be altered by the Board of Trade in such manner as they may think expedient for giving effect to this section."

CHAPTER VII

CARRIAGE OF PASSENGERS

Passenger Vehicles—Increased Weight of Trains—Increased Speeds—Diminished Remuneration from Passengers—Are First-class Passengers Profitable?—The Loading of Passenger Trains—Mr. Aslett's Plan—Passenger Fares—Return Tickets—American Travelling.

THE present era of railway travelling dates from 1872, when the Midland Railway inaugurated the policy of treating third-class passengers as a source of revenue worthy of consideration and encouragement. Up to that time the railways had united in regarding them as little more than a necessary evil that must be kept down to the smallest possible dimensions—a point of view that lingered in the minds of a few railway magnates—*e.g.*, the late Sir Edward Watkin—down to a much more recent date. It is true that by 1872 third-class travellers had secured the privilege, denied to them in the early history of railways, of riding in vehicles roofed in and so affording protection from the more violent assaults of the British climate. Parliament, too, had ordained that every railway should run daily in both directions over its system at least one train by which the fares did not exceed one penny a mile. But apart from such "Parlia-

mentary" trains, which stopped at every station and ran at an average speed of less than 20 miles an hour, the traveller in the cheapest class had to pay a fraction over a penny a mile, and was excluded from all the good trains. What the Midland did in 1872 was to admit third-class passengers into all its trains, and in so doing it was necessarily imitated more or less promptly and completely by the other railways of the country. Three years later it carried its innovations a step further, and, deciding to abolish second-class compartments altogether, improved its third-class accommodation to the level of the old second. At the same time it readjusted its first-class fares on the basis of about 1½d. a mile. Although the practice of having only two classes was by no means unknown—the Caledonian had adopted it partially, and the Great North of Scotland never had anything else—this action on the part of the Midland caused great perturbation among the other companies, and six of the most important of them took joint action in the hope of preventing it from being carried out, at least without modification. Their efforts, however, were unsuccessful. The Midland directorate, claiming the right to manage their own affairs as they thought best, declined to alter their arrangements, and in their abolition of second-class carriages they have since been followed by three out of the six remonstrant companies, and by all the railways in Scotland.

About the same period an important change began in the mode of constructing passenger rolling stock, in addition to the improvements in the internal upholstery. The earliest passenger carriage was

practically a stage-coach with two axles and four wheels. In course of time the body was made longer, and the desirability was seen of supporting it on three axles and six wheels, the middle axle having a certain amount of lateral play to facilitate running round curves. A third stage in the evolutionary process was marked by still longer vehicles, having eight wheels and four axles (sometimes twelve wheels and six axles) which were grouped at each end of the car in bogie trucks, mounted on a swivel and so capable of adapting themselves easily to curves or irregularities of the track. Cars of this sort, 57 feet long, were imported by the Midland from America in 1874, and, although not always viewed with favour at first, are now to be found on almost every railway in the country. They have become, indeed, the standard rolling stock for fast main-line traffic, and are even being used by some companies—*e.g.*, the London and North-Western, London and Brighton, and London and South-Western—for local traffic, though here the four- or six-wheeled vehicle will probably maintain its ground, except in cases where electric traction is employed.

From the point of view of the traffic manager and the locomotive engineer, the introduction of these bogie vehicles has been of even greater moment than to the passenger, who enjoys a smoothness and easiness of travelling unattainable without them, for they are responsible for a large increase in the weight of trains. The standard third-class carriage of the early 'seventies weighed about 10 tons, and had seating capacity for fifty passengers in five compartments; that is to

say, about 4 cwt. of wood and iron was hauled for each passenger. Fifteen years later, longer bogie carriages were becoming more frequent, and those with a weight of about 18 tons carried seventy people in seven compartments; the weight per passenger was therefore about 5 cwt. The next factor that increased the weight per passenger was the introduction of lavatories, which, at first provided for first-class passengers only, were under the stress of competition gradually granted also for second- and third-class, though not for every compartment. A development of this practice led to the evolution of the corridor carriages and trains, which may fairly be regarded as the standard of the present day for through main-line traffic. These corridor trains, first put on in this country by the Great Western in 1892, represent a very great increase in weight. Not only do they involve a reduction in the seating capacity of each compartment from ten to six, with a proportionate increase of weight per passenger, but they have led to an extended use of dining-cars, which are among the heaviest vehicles employed on British railways. At the present time the standard third-class corridor carriages on the Midland Railway weigh 25 tons, and hold thirty-six passengers, each of whom therefore involves the haulage of nearly 14 cwt. of dead weight. The corridor stock of other railways works out in much the same way. Dining-cars mean an even greater weight per passenger: *e.g.*, a Midland car, weighing over 32 tons, holds forty-two persons (15 cwt. each), and the longest cars of the London and North-Western weigh 40 tons, and hold only

forty-two passengers (third-class), though a portion of their space is taken up by a kitchen. In some cases, too—*e.g.*, the London and North-Western Scotch expresses—the dining-cars represent a sheer addition to dead weight, and add nothing to the capacity of the train, because passengers are only allowed to use them while eating a meal, and at other times are required to occupy seats in the ordinary carriages. While, therefore, thirty years ago, two hundred third-class passengers could have been taken from London to Glasgow in a train consisting of four coaches and weighing about 50 tons, including a brake-van, to convey the same number in the style expected by Scotch passengers to-day would require six coaches and a dining-car, weighing with a brake-van about 200 tons. The weight for first-class passengers is, of course, still greater, because they are allowed more space. The maximum is reached in sleeping-cars. The latest examples on the North-Western are 69½ feet long over the buffers, weigh 40 tons, and have sleeping-berths for only eleven passengers, each of whom, therefore, accounts for over 3½ tons of dead weight.

But even this increase in dead weight and reduction in capacity is not the full measure of the disadvantages under which the railway manager of to-day has to work as compared with his predecessor in 1870. Besides having to run heavier trains, he has to run them at much higher speeds. The acceleration which has been effected in British passenger trains during the last generation is a matter of common knowledge, but one or two illustrations may be interesting. In 1872 the best train between London and Liverpool

was timed to run 201 miles in 5¼ hours, or 38½ miles an hour. Fifteen years later, though over 8 miles had been taken off the running distance by the construction of Runcorn Bridge, the best train was allowed only 4½ hours, a speed of nearly 43 miles an hour; while to-day the best train performs the journey in 3 hours 55 minutes, at an inclusive speed of over 49 miles an hour. Between Euston and Birmingham in 1872 the quickest time was 3¼ hours; this by 1888 had been reduced to 2¾ hours, and since then it has gradually come down, till in 1902 a train was put on which covers the 113 miles in the even two hours. A third illustration may be given from the service between England and Scotland. Thirty years ago, to travel by the morning train from London to Edinburgh required 11 hours; fifteen years ago the time had been reduced to 8½ hours by the same train; now it is 8¼ hours; while by a night train the traveller on the East Coast route can complete the journey in 7¾ hours.

Such accelerations, of which many more instances might be quoted, have been accomplished in two ways—by increasing the running speed, and by eliminating intermediate stops. The latter has become a very favourite device of late years. The longest regular non-stop run is done by the Great Western between London and Exeter (193¾ miles). In 1901 three trains were booked to perform this feat, the quickest being allowed 3 hours 38 minutes; in 1902 there were four, the time being reduced to 3 hours 37 minutes; while in the summer of 1903 there were again four trains, and the time was reduced

to 3 hours 30 minutes, the speed thus being over 55 miles an hour. The next longest run is performed by the North-Western's American boat expresses from London to Liverpool, which do not stop between Euston and Edge Hill (191 miles). Among the newest long-distance runs are those established in 1903 by the Great Northern between Wakefield and King's Cross (176 miles), and by the Great Central between Marylebone and Sheffield (164¾ miles). Even longer runs have occasionally been accomplished without any stop, though they have not, so far, found their way into the regular time-tables. The North-Western, for instance, in 1903 ran a train, containing the members of the International Telegraph Congress, without a stop from Euston to Carlisle, a distance of all but 300 miles, and shortly afterwards the Great Western conveyed the Prince and Princess of Wales from Paddington to Plymouth (245¾ miles) without a stop in 233½ minutes.

Whether time is saved by reducing the number of stops or by increasing the running speed, accelerations of this kind mean increased expense. The higher the average of speed the stronger must be the permanent way and bridges, in order to withstand the severer strains to which they are subjected, and the heavier must be the capital outlay for construction. Greater expenditure in labour and material, again, is necessary to meet the wear and tear, and the larger locomotives which must be employed cost more to build and more to maintain, and involve increased consumption of coal, water, and oil. The elimination of intermediate stops, again, must tend to increase the train-mileage, for in

many cases new trains must be put on to serve the places omitted by the through trains. Further, at intervals along the line, water-troughs or "track-tanks" must be laid down from which the engines can pick up the water they require without stopping, and these cost money to install and money to maintain. Such water-troughs were introduced on the North-Western by Ramsbottom many years ago, and of late they have been adopted by several other lines, such as the Great Western, Great Central, and Great Northern.

On the other hand, it is sometimes urged that even the best speeds of the present day are not good enough, and that they should be increased 30 or 40 per cent. to an average of, say, 70 miles an hour, start to finish; and it is suggested that railways would find such acceleration to their advantage, because quick trains attract passengers, while increasing the capacity of the line. That they attract traffic in the sense that most travellers choose the fastest trains at their disposal may be admitted, but that they create new traffic to any important extent is more doubtful. There is, after all, only a limited number of people who wish to travel, whether for business or pleasure, and this number is not capable of indefinite expansion merely by the expedient of running trains at 70 instead of 50 miles an hour. Of course, a good train service to a place stimulates traffic to it as compared with another place that has a poor service; but it is difficult to believe that, if all the railways running between London and Edinburgh began to-morrow to complete the journey in 5½ or 6 hours, they would

find they secured any substantial increase in their traffic as compared with what they now get in trains which take 7¾ or 8¼ hours.

As to the capacity of the line being increased, something of the sort might be looked for if all the trains, goods and passenger, could be run at the same high speed. But such equality of speed is admitted to be quite out of the question; yet the introduction of a few very fast trains would simply emphasise the inequality of speeds, which is the great trouble on a crowded railway. A line's capacity is greatest when every train on it runs at the same speed, and the greater the departures from the mean, either in way of excess or defect, the more is its carrying power impaired. It is quite true that a very fast train leaves the line clear behind it more quickly than a slow one, but it also requires the line clear for a much greater distance ahead. The Metropolitan District has an extremely heavy train-mileage, and on its main line between the Mansion House and South Kensington Stations (about 4 miles, run in 22 minutes) there are at busy times about twenty trains an hour in each direction. Think of the result of trying to run expresses at 60 miles an hour over that line; one an hour would mean reduction of the slow traffic by one-third, three an hour its practical abolition. This is an extreme case, but the principle holds good on all lines where there is a dense traffic running at unequal speeds. The greater the inequality of speed, the fewer the number of trains that can be passed over a given distance in a given time; and the introduction of a few 70 miles an hour trains on a busy

line would mean a reduction, not an increase, in the carrying capacity. This point is well shown from the diagram on p. 52. If all the trains ran at the same speed all the diagonal lines would be parallel, and none would cut any of its neighbours. But the faster a train the smaller the inclination from the vertical of the line representing it, and the larger the number of other lines cut by that line; in other words, the larger the number of trains interfered with.

Supposing, however, that all the advantages were on the side of very fast trains, it is by no means certain that they would be practicable in an engineering sense. A train which averages 50 or 55 miles an hour, often for short distances runs at 70 or even 80 miles an hour; similarly, to maintain 70 on the average, it would probably be necessary in places to run at the rate of 90 or 100 miles. Doubtless, speeds of this order have occasionally, though rarely, been touched in ordinary practice in very favourable conditions—on straight pieces of line and downhill; but to attain them regularly and with safety on the gradients and curves which have to be faced on every existing railway is a very different matter. In the Berlin-Zossen trials an electrical car did attain a speed of nearly 100 miles an hour, but the line was specially built nearly straight with easy gradients, thus presenting conditions that could rarely, if ever, be realised on an ordinary railway. Even so, the weight of the car (92 tons), combined with the high speed, played havoc with the permanent way in its original form, and the expense had to be incurred of using heavier rails and special strengthening devices before the track proved

capable of bearing the speeds of over 120 miles an hour ultimately attained. Believers in the Behr Monorail system of construction claim that it will solve the engineering problems connected with running at speeds of 100 miles an hour; but it will be possible to discuss its merits with more certainty when the projected line between Manchester and Liverpool has been built and shown to be satisfactory in practical operation.

Granting, however, the possibility, from the engineer's point of view, of making locomotives to haul trains at 100 miles an hour, and the ordinary track strong enough to stand the strain, there still remains the question, Would the game be worth the candle? On the one hand, it is undeniable that such extreme speeds would entail greater cost, in construction of the line and engines, in running expenses, and in the disturbance inevitably caused to other traffic; on the other, there is no reason to anticipate an increase in the earnings of such trains as compared with present expresses, but rather the reverse. Among the fastest runs ever made in this country was that of the London and North-Western by the 8.0 p.m. out of Euston on 22nd August 1895, when the 141¼ miles between Crewe and Carlisle were covered at the rate of 67·2 miles an hour, and that of the Great Western (already mentioned) on 14th July 1903, when the 10.40 from Paddington reached Plymouth at the rate of over 63 miles an hour, and for two hours maintained an average speed of 67¾ miles an hour. But the load in the former case was very small—only three coaches—and the number of passengers that

could be accommodated, and consequently the receipts, trifling in comparison with those which could be taken in an ordinary Scotch express with three or four times as many coaches. In the Plymouth run the load was greater, five coaches, but was still only half what would be taken on an ordinary train. Yet it is safe to say that in neither case could the same result have been achieved under normal commercial conditions, that is, if the trains had been of the size that are usually run from Euston to Scotland and Paddington to the West.

To return from this digression on very high speeds, it appears from what has already been said that railways are now obliged to carry on their passenger business in a more costly manner than used to be the case a generation ago. But more than that, for the transportation they purvey they have had to accept a gradually decreasing price. Before 1872 they excluded third-class passengers altogether from the fastest trains, and very often obtained specially high rates, in the shape of express fares, from the first- and second-class passengers, or perhaps only first-class passengers, whom they did carry. Now the train that does not convey passengers at one penny or less a mile is an exceedingly rare exception; express fares are practically unknown, and the ordinary first- and second-class fares are distinctly lower than they used to be. Moreover, there has been a steady transfer from the superior classes to the lowest, and people who twenty or thirty years ago would have thought it unworthy of their social standing to travel third-class now do so without hesitation. The change is

illustrated by the table on the next page, which shows the gross receipts per train-mile obtained from the different classes of passengers in 1871 and in 1901. It will be seen that, during the thirty years covered by the table, there has been all over the United Kingdom a heavy decline in the receipts per train-mile from first-class passengers. In England they are only one-third of what they were in 1871, and in Scotland and Ireland the decrease has been nearly as great. From second-class passengers English railways get only one-quarter per train-mile of what they got in 1871. For Scotland no comparison is possible, since all second-class carriages have been abolished, but in Ireland the fall has been almost one-half. These decreases have to some extent been compensated for by the higher yield from the third-class and from season tickets; but, in spite of that, each train running a mile now earns substantially less than it did before the upheaval caused by the Midland's policy in 1872–1875, viz., 7d. less in England, 3d. less in Scotland, and 6d. less in Ireland. In the thirty years the gross receipts in England have rather more than doubled, the train-mileage has increased two and a half times, and the number of passengers more than trebled. In Scotland the receipts are not quite two and a half times as great, the train-mileage is about two and a third times as great, and the number of passengers has increased fourfold. In Ireland the receipts have increased by nearly one-half, and the train-mileage and the number of passengers by some three-quarters. The general conclusion to which these figures point, even when allowance is made for disturb-

		1871.			1901.		
		England and Wales.	Scotland.	Ireland.	England and Wales.	Scotland.	Ireland.
Receipts per Train-mile.	First .	11·4d.	8·7d.	10·3d.	3·8d.	3·8d.	3·7d.
	Second .	15·0	6·2	11·8	3·7	...	6·5
	Third .	21·8	22·0	18·3	31·7	28·8	24·0
	Season .	2·2	1·6	1·3	4·0	3·0	1·5
	Totals	50·4d.	38·5d.	41·7d.	43·2d.	35·6d.	35·7d.
Gross Receipts from Passengers.	First .	£3,504,124	£379,626	£264,358	£2,924,297	£431,287	£165,379
	Second .	4,596,317	268,108	303,110	2,862,875	...	238,588
	Third .	6,692,971	951,413	470,920	24,524,219	3,290,817	1,085,213
	Season .	678,861	70,575	32,342	3,141,176	361,795	70,407
	Totals	£15,472,273	£1,669,722	£1,070,730	£33,452,567	£4,083,899	£1,559,587
Number of Passengers (excluding Season-ticket Holders).	First .	30,092,538	3,600,786	1,948,875	27,263,090	5,936,682	1,422,369
	Second .	73,011,105	3,687,070	4,323,765	65,226,964	...	3,627,805
	Third .	225,449,303	23,832,018	9,275,294	928,688,796	118,427,036	21,803,158
	Totals	328,552,946	31,119,874	15,547,934	1,021,178,850	124,363,718	26,853,332
Passenger Train-miles . .		73,449,566	10,384,996	6,162,313	185,852,615	27,380,005	10,819,279

ing factors, is that the railways of this country at the present time, as compared with the early 'seventies, not only do a great deal more work, but have to accept a considerably lower rate of remuneration for doing it.

In view of the smallness of the return per train-mile received from first- and second-class passengers, it has sometimes been doubted whether the railways make any profit at all on carrying them. Sir George Findlay, the late general manager of the London and North-Western, was inclined to share this opinion, at least so far as regards long-distance traffic. Figures he worked out for the line with which he was connected purported to show that, while the profit of carrying one first-class passenger one mile was in 1871 approximately ·85d., in 1888 it had fallen to ·12d. On this he comments (*Working of an English Railway*, p. 258): "It must be borne in mind, moreover, that although the figures show a profit, however small, upon the carrying of first-class passengers, this result is only arrived at as an average by treating all first-class passengers alike; and while it may still be a profitable business to carry first-class season-ticket holders, or passengers by local and suburban trains, it may well be doubted whether, under present circumstances, upon first-class passengers carried long distances by express trains—say between London and Scotland—there is any profit at all."

The question, however, is complicated, if not rendered impossible of exact solution, by the absence of necessary data. While it is within the power of a railway company to make a pretty close approximation to the

average amount paid by each passenger per mile, a trustworthy estimate of how much each costs to carry is far more difficult, because it involves the accurate apportionment, (1) of the total working expenses between goods and passenger traffic, and (2) of the passenger expenses between the different classes—a task which, as was shown in Chap. VI., presents practically insurmountable obstacles. Statistics, therefore, which profess to set out the precise profit or loss per passenger-mile of any class should be accepted with reserve, if not with suspicion.

It may be questioned, indeed, whether it is justifiable at all to treat the receipts and expenses of one class of passengers as separate from those of other classes, or indeed any one portion of a railway's business as distinct from another. If the London and North-Western were to take a train containing only a dozen passengers from London to Edinburgh, it would do so at a loss, even if they all paid first-class fares, since the receipts would not cover the bare working expenses of running the train. But if these twelve first-class passengers are conveyed in the same train that carries a hundred third-class passengers, the case becomes very different. The bare working expenses are now far more than covered, and every additional penny that train earns is profit which can be used in meeting the fixed charges and paying dividends. It is difficult, then, to believe, as would seem to follow from Sir George Findlay's theory, that the railway would make less profit on a train containing one hundred third-class plus twelve first-class passengers than on one containing one hundred and twelve third-class passengers only,

unless, indeed, the capital cost of the first-class accommodation provided were so high that the twelve first-class fares would not be sufficient to provide a fair rate of interest upon it. This supposition is rather improbable, unless the number of first-class seats is extravagantly out of proportion to the number of first-class travellers, in which case faulty management may be suspected.

A favourite accusation against British railways is that they fritter away their money by running trains far longer and heavier than are required to accommodate the passengers travelling in them. It would, of course, be futile to deny that the passenger trains in this country are on the whole not loaded up to their full physical capacity, but critics sometimes underestimate the difficulties a railway manager has to face in the matter. Even if he were absolutely perfect, he could not contrive to have all his trains always perfectly full; he could only do his best in the circumstances in which he was placed, and many of those circumstances must be entirely outside his control. For instance, in August people flock from England to Scotland, while fewer travel in the reverse direction. This is not his fault, neither is the inevitable consequence, that the trains to London at that period are somewhat empty. The carriages must be got back to the south somehow, and it may cost less to attach them to regular trains, even though not required for the traffic, than to run specials of empties.

Or, take a suburban train starting from London at five or six in the afternoon and running twenty miles

into the country. At starting every seat is occupied, but at each successive stoppage passengers get out and few new ones enter, so that it reaches its destination with perhaps one person in each compartment. It has run the latter part of its journey very poorly loaded; but what is the manager to do? It has been suggested that he might take off a coach at each station, so that the rest of the train might continue its journey well filled. This suggestion, however, scarcely makes for economy or speed or safety, and the cost of keeping an engine at each station to shunt the dropped carriage, and the loss of time involved by the converse operation of attaching a carriage at each station to some train next morning would far outweigh any advantage to be gained by hauling a shortened train.

Again, there may be times when the traffic on a line is so slack as not to provide a fair train-load; the manager then has to choose between denying all facilities to the few people who do want to travel, and running a train which perhaps barely pays its expenses. With the fear of public opinion and the possibility of a rival line before his eyes, he perhaps elects to adopt the second alternative, and possibly runs far more coaches than are required, because the train on its return journey will have to cope with a very heavy traffic. The result is that he gives an opportunity to superficial critics of blaming him for running unfilled trains; yet would not the blame be more fairly fixed on circumstances which he is powerless to alter?

The loading of first-class carriages, however, seems

a field in which there is room for improvement, especially in long-distance journeys. It is not difficult to show that a large proportion of the first-class accommodation provided in British trains is not utilised under present conditions. In 1901 the average amount obtained per train-mile by English and Welsh railways from first-class passengers was barely 5½d.—less than 4d. from ordinary passengers and nearly 1½d. from first-class season tickets. If the average first-class fare be taken as 1½d. a mile, this means that on the average the railways had less than four first-class passengers for each train-mile run, but, to be on the safe side, let us say five. Now the smallest number of first-class compartments that under the Railway Regulation Act (1868) can be run in any train is two—one for smokers and one for non-smokers—and the smallest number of seats provided in these two compartments is eight. This minimum is for corridor trains; an ordinary first-class compartment more often holds six, and in suburban trains the normal complement is ten. It follows that, at the very least, three-eighths of the first-class space must in 1901 have been unoccupied, and therefore a source of waste, not of profit, even supposing that all the trains were corridor trains, and that the minimum of two first-class compartments was universally observed. But how many trains are run in this country with only two first-class compartments? and what proportion of them are made up solely with corridor stock?

The step which was taken by certain railways in

1896 of reducing the second-class fares had a distinct effect in increasing the receipts per train-mile from that class. On the London and North-Western, for example, the sum of 3·6d. per train-mile received in 1891 from second-class passengers had become 4·8d. in 1901, the gross receipts rising from £322,977 to £539,618. Might not a reduction in first-class rates have a similar effect in improving the first-class receipts per train-mile? If it be contended that the cost of first-class carriages—weight, space, fittings, upholstery, etc., being taken into account—is so high that fares lower than those now in force could not possibly pay, then a way out of the difficulty might be found by reducing that cost. Most people who take first-class tickets do so, not for the sake of the extra gilt and upholstery, but because they get more room and more select company; indeed the accommodation provided in the third-class carriages of the leading lines is already about as good as is wanted by anyone who is not an invalid. If, therefore, the railways were to make up their trains—at least their long-distance trains—of stock equal, or perhaps slightly superior, in point of roominess to the present best third-class stock, some system of restricting the number of passengers in certain compartments, on payment of an additional fee, would secure the main advantage of two classes without entailing the cost of first-class carriages.

A plan of this kind was introduced on the Furness Railway by Mr. Aslett, the general manager, in 1897. He abolished second-class compartments altogether, and instead issued supplementary reserved tickets to

passengers holding third-class tickets, at the following scale:—

Up to 15 miles	. . .	3d. per passenger.
16 to 30 ,,	. . .	6d. ,, ,,
31 to 50 ,,	. . .	9d. ,, ,,
51 to 75 ,,	. . .	1s. ,, ,,
76 to 100 ,,	. . .	1s. 3d. ,, ,,
101 to 150 ,,	. . .	1s. 6d. ,, ,,

A number of the third-class compartments in each train were marked "Reserved Tickets" by the aid of adhesive labels, and were set apart for the exclusive use of the holders of supplementary tickets. In this way a virtual second-class was created without any extra cost for superior fittings, and a certain elasticity was given to the accommodation, since the station-masters and guards were provided with labels and the number of reserved compartments could be altered at any time according to the requirements of the traffic. This plan, which might obviously be extended to first-class traffic, proved satisfactory in actual practice, but was discontinued because the Inland Revenue insisted on the payment of passenger duty, on the ground that the supplementary ticket made the third-class fare more than a penny a mile.

The maximum fares which the older companies were very generally authorised by their Acts of Parliament to charge for conveying a passenger for one mile are 3d. if he be carried in a first-class compartment; 2d. if in a second-class; 1½d. if in a third-class; and 1d. if in a "Parliamentary train." Within these maxima they can charge what they like, free

from legal interference, except in three cases regulated by the Cheap Trains Act of 1883—(1) They must carry parties of His Majesty's army, navy, or police at fares reduced in proportion to the number of the party. (2) The old provision requiring one "Parliamentary" train a day in each direction has been repealed, and instead they are bound to provide what, in the opinion of the Board of Trade, is a "due and sufficient proportion" of accommodation at fares not exceeding one penny a mile. (3) They have to run "proper and sufficient" trains for workmen going to and returning from their work, at such fares and at such times between 6 p.m. and 8 a.m. as may appear reasonable to the Board of Trade, the matter being taken before the Railway Commission for final settlement if required.

But, quite apart from the operation of the Cheap Trains Act, the legal maxima are practically inoperative, and are only charged on one or two small struggling lines, which perhaps owe part of their misfortunes to the shortsighted policy of their management, which stifles traffic by excessive charges instead of encouraging it by liberal treatment. The normal scale on which passenger fares are now generally calculated in England is about 1½d.–2d. a mile first-class, 1¼d. second-class, and 1d. third-class. It may be asked why railways are content to base their fares on charges so much below those to which they are legally entitled? The answer is that, in the opinion of their managers, high fares would act so powerfully in the direction of restricting travel that the gross receipts would be less than those yielded by the lower fares; in other words,

the legal maxima are greater than the traffic will conveniently bear. More money is received from carrying five persons at 2d. each per mile than three persons at 3d. each; and if a railway by reducing its fares, say, 20 per cent. can induce double the number of passengers to use its trains, the reduction is obviously profitable, provided, of course, that the task of accommodating the increased traffic does not involve a proportionate increase of expenditure.

The principle of charging what the traffic will bear explains all the various special tickets—tourist, week-end, excursion, etc.—issued at fares below the normal, as well as almost every anomaly that may be discoverable in the fare-lists. By the aid of cheap tickets, a railway counts on attracting into its trains a class of people who could not otherwise afford to travel, and it naturally thinks it better to make a small profit from these people than to make nothing out of them at all. Even those fares which by stress of competition are reduced below the normal mileage rate are only instances of charging what the traffic will bear. If there are two routes between two towns A and B, the distance by one being 48 miles, and by the other 60 miles, then the third-class fares by both will be 4s., because the manager of the line owning the longer route knows that his traffic will not bear a charge higher than the fare paid on the shorter route, and that if he tried to obtain the full mileage rate of 5s. he would simply drive everyone wishing to travel between the two places into the trains of his rival. But he is quite within his rights in charging the full mileage fare to a place C on his line, six miles

short of B, that is, in making the third-class fare from A to C 4s. 6d., although for the longer distance, A to B, it is only 4s. Whether, however, he is wise in so doing is sometimes rather doubtful, because, for the sake of an unimportant sum, he is liable to stir up a feeling of irritation among his patrons, who cannot see any valid grounds for such an exception to the general rule that the greater includes the less. If he tried to do the same thing for goods traffic, it would be at the risk of finding that the Railway Commission had something to say to him on the score of giving undue preference to the traders of B against those of C; but at present railways can congratulate themselves that the doctrine of undue preference has not yet been introduced into passenger business.

What precisely the railways of Great Britain receive on the average per passenger per mile it is not easy to say, because the Board of Trade Returns give no information on the point, and their reticence is imitated in the companies' own reports. The North-Eastern, however, has compiled statistics which showed that in May 1901, excluding season-ticket holders, for each first-class passenger it conveyed one mile, it received on the average 1·42d., and for each third-class passenger 0·64d. The smallness of these amounts, which would be still smaller if season tickets were included, is certainly surprising at first sight, and it is possible that rather more is received by some of the other big lines; but the surprise is lessened when account is taken of the large numbers of cases in which tickets are granted at less than the normal scale given above. The millions of tickets

issued to workmen at exceedingly cheap rates must alone exert an enormous influence in reducing the average fare per mile. Apart from this, take, by way of illustration, the various fares charged by the London and North-Western between London and Edinburgh, a distance of all but 400 miles. Edinburgh, it may be noted, is not exceptionally favoured in regard to the terms on which it may be reached by railway travellers from London, and between hundreds of other places similar tickets are issued at similar rates. From Euston to Princes Street the single third-class fare on the 1d. a mile basis should be 33s. 4d., but in fact it is only 32s. 8d., and, on taking an ordinary return, the passenger, instead of paying double that amount, or 65s. 4d., is allowed a rebate which brings the fare down to 62s. 8d.; while in the summer months, from May to October, when "tourist" tickets are issued, the return costs only 50s. First-class tickets cost 57s. 6d. single and 109s. 6d. return, both fares representing considerable abatements from the 2d. a mile rate. Then, all the year round, week-end tickets available for the outward journey on Friday or Saturday, and for return on Sunday, Monday, or Tuesday, can be purchased for 59s. 6d. first-class, and 33s. 9d. third-class; and in the summer (and at holiday seasons, such as Christmas and Easter) excursions are run every week or oftener, by which passengers can go to Edinburgh and back for 26s. The price per mile at which each of these tickets works out is shown in the following table, and the reader may be reminded that children between the ages of three and twelve travel at half rates, though they

occupy as much room (sometimes more) as the adult, and each counts one in the passenger returns:—

EUSTON TO EDINBURGH (400 miles).

Ticket.	Fare.	Rate per Mile.
First-class single ordinary	57s. 6d.	1·725d.
,, return ordinary	109s. 6d.	1·517d.
,, ,, week-end	59s. 6d.	·892d.
Third-class single ordinary	32s. 8d.	·98d.
,, return ordinary	62s. 8d.	·94d.
,, ,, tourist	50s. 0d.	·75d.
,, ,, week-end	33s. 9d.	·506d.
,, ,, excursion	26s. 0d.	·39d.

It will be noticed that in these fares only a trifling reduction is made in the charge for ordinary return tickets as compared with two single fares. Formerly it used to be a rough rule that a return ticket only cost half as much again as a single one; but that day has passed, and now the tendency is towards charging double fare for the double journey. The advantage of taking return tickets has thus disappeared in many cases, and the saving of a few pence may be dearly bought under the restrictions imposed as to time of return. The availability of the backward halves of return tickets is fairly uniform in England. As a rule, for distances up to 12 miles, the return half is available on the day of issue or following day, or from Saturday to Monday; for distances between 12 and 50 miles, eight days are allowed for return; and for distances over 50 miles, one month. The North-Eastern extends the period of tickets for 12–50 miles to a month. Between England and stations in

Scotland and Ireland the allowance is more liberal, being two months for ordinary return tickets, and for tourist tickets till the end of the year in which they are issued. In Scotland itself the arrangements are more liberal still, for between Scotch stations return tickets are generally available for six months; and in a number of cases—*e.g.*, between Glasgow and the coast—they are available for ever, *i.e.*, both the outward and backward portions may be used at any time at the option of the owner.[1] In the matter of week-end (Friday or Saturday to Monday) tickets, the Scotch

The particulars given on page 144 regarding the availability of return tickets on English railways will require modification as from 1st July 1904, since the companies have adopted a change which, as indicated on page 145, has been under discussion for some time past, and have generally agreed to make ordinary return tickets issued on and after that date for distances exceeding 20 miles available for six months. Those for shorter distances remain as at present.

To face p. 144.

overcome by the Scotch lines in the case mentioned. An English general manager recently proposed to the General Managers' Clearing House Conference that the time should be generally extended to six months, but his revolutionary proposal was not received with approval.

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Payment of any of the different classes of fares quoted above, except those for special excursion trains, entitles the passenger to make use of any of the Scotch expresses without exception; and thus the holders of third-class tourist tickets at three-farthings a mile, and of third-class week-end tickets at just

[1] Railway travellers often wonder why all ordinary return tickets are not made available indefinitely. The objections to this course are connected with questions of audit and checking the receipts, but can probably only be fully appreciated by a railwayman. The difficulties, however, are evidently not insuperable, since they have been overcome by the Scotch lines in the case mentioned. An English general manager recently proposed to the General Managers' Clearing House Conference that the time should be generally extended to six months, but his revolutionary proposal was not received with approval.

over a halfpenny a mile, are enabled to travel in comfortable, well-upholstered carriages, with lavatories and dining-cars, often at an inclusive speed of 50 miles an hour.

A comparison with American railways is interesting. According to the report of the Inter-State Commerce Commission, the average revenue per passenger per mile obtained by all the railways in the United States in 1901 was 2·013 cents. That, of course, is for travelling in the ordinary cars—long open vehicles with seats placed transversely and a passage along the centre. For short journeys by day these are well enough, but for long journeys they are less tolerable, especially by night, since the arrangement of the seats precludes any possibility of lying down. Hence, on most long-distance trains, Pullman cars are run, in which at night two tiers of sleeping-berths can be made up, and for the use of these an extra charge is made by the Pullman Company, which owns them, over and above the fares collected by the railroad companies. Many of the best trains consist entirely of Pullman cars of various descriptions, or their equivalent, so that the actual cost of travelling in them is necessarily more than the two cents (one penny) a mile.

Then, as to speed, a few trains in America surpass anything that is to be found in Great Britain. Thus, between Camden and Atlantic City there are trains which run 66½ miles an hour from start to finish, and, if distance also is taken into account, the daily performance of the "Empire State Express," which is booked to maintain an average speed of 53¼ miles an

hour for the 440 miles between New York and Buffalo, is unequalled in Great Britain. But, apart from a few splendid exceptions such as these, the average speed is well below that attained in this country, and for the exceptions the traveller has generally to pay extra, either in the way of Pullman car charges, or of higher fares, or both. For instance, the normal time for the journey from New York to Chicago is looked upon as 28 hours, but some trains do it in less time, and passengers by these have to pay one dollar for each hour knocked off that time. Now the "20th Century Express" of the New York Central runs the 980 miles between the two cities at an inclusive speed of 49 miles an hour in 20 hours; hence the normal fare of $20 becomes $28. In addition the passenger has to pay for a sleeping-berth, which cannot be had for less than $5, and may cost more; he therefore pays in all at least $33, or 1·68d. a mile. In Great Britain there are no through journeys so long as 980 miles; but from Euston to Aberdeen, 540 miles, it is possible to travel at an inclusive speed of 48 miles an hour for 0·83d. a mile, third-class, or during six months of the year with a tourist return ticket for 0·62d. a mile; while for 1·65d. a mile a man can travel there and back first-class in a sleeping-car with a separate compartment entirely to himself, not merely a berth in a general Pullman car, where a curtain is all that shuts him off from a dozen other sleepers, some perhaps women.

English railwaymen are sometimes accused of not being properly in touch with what is done on American railways. That occasionally the position is reversed

may be seen from the following quotation from an address delivered at the Chautauqua Assembly in August 1902, by Mr. George H. Daniels, the enterprising general passenger agent of the New York Central:—

"It is beyond question that American railroads to-day furnish the best service in the world at the lowest rates of fare, at the same time paying their employés very much higher wages than are paid for similar service in any other country on the globe. In the United States the first-class passenger fares in 1898 averaged 1·98 cents a mile, although on some large railways the average was several mills less than two cents per mile. In England the first-class fare is four cents per mile; third-class fare for vastly inferior service is two cents a mile, but only on certain Parliamentary trains. . . . Our passenger cars excel those of foreign countries in all that goes to make up the comfort and convenience of a journey. Our sleeping and parlour car system is vastly superior to theirs; our baggage system is infinitely better than theirs, and arranged on a much more liberal basis. American railroads carry 150 pounds of baggage free, while the German roads carry only 55 pounds free. The lighting of our trains is superb, while the lighting of trains on most foreign lines is wretched."

It is, of course, mainly a matter of taste whether the "lonesome" English compartment is or is not preferable to the long, open American car in which some sixty or eighty people may be thrown together, with a view of a lavatory for men at one end and a lavatory for women at the other. For those, too, who like

company, there is a good deal to be said for the American sleeping-car. But the amounts paid are a matter of fact. In Great Britain one can travel, not merely in "certain Parliamentary trains," but in practically every train in the country, for one penny (two cents) a mile, and often less. In America the "first-class" fare of 1·98 cents a mile corresponds to our third-class rate, since there is in general nothing cheaper. The real first-class is provided by the Pullman cars, for the use of which an extra payment is required, and experienced travellers will tell you that four or five cents (2d. or 2½d.) a mile is a fair allowance for railway expenses in the United States, including the charges for sleeping and parlour cars. In fact, American railroads cling to the practice—now generally looked upon as antiquated in this country—of admitting to their best trains only those passengers who pay the highest rates; and, so far from the man who pays a penny a mile getting in England a "vastly inferior service" as compared with what he gets in America, he really enjoys a considerably better one, because he has the choice of more trains and of faster trains. Nor, on the whole, are his physical comforts less carefully attended to, even though the epithet "superb" cannot often be applied to the lighting arrangements—it is a little strong even for American railroads—and the heating is not always quite as perfect as could be desired.

CHAPTER VIII

CARRIAGE OF GOODS

Standard British Trucks—The Argument for Wagons of greater Capacity—Difficulties in the way of their use in this Country—"Private" Wagons—Small Consignments—Prompt Delivery—Big Trains and Full Loads—Mineral Trains—General Merchandise Trains—Limiting Factors in the Size of Trains.

THE transportation of merchandise and minerals in this country is almost entirely effected by means of trucks or wagons having two axles and four wheels. These differ to some slight extent in the mechanical details of construction, and also in form according to the character of the goods each is designed to carry—some being open, others closed, some having high sides, others low ones, some for the purpose of discharge being provided with doors at the side, others with doors at the bottom through which the contents pass by gravity when a catch is released. But in spite of minor differences, since practically every wagon must, in the conditions of traffic which prevail in Great Britain, be capable of running over every line in the country of the same gauge, it follows that in certain particulars uniformity is essential. For example, no wagon must exceed a certain height and

width, else there will be a danger of its coming into contact with fixed structures like bridges and platforms. Again, since wagons belonging to different companies have frequently to be run in the same train, uniformity is insisted on in such matters as the diameter of the wheels, the height of the buffers above the rails, the coupling chains, and many other details of equipment. Some idea of the general practice may be gathered from the requirements which the railway companies unite in imposing on the privately owned wagons that work over their lines. Among the provisions of the "Standard Specification" (1903) for 10- or 12-ton private wagons are the following:—No wagon is to be more than 8¼ ft. wide over all, or more than 10 ft. high at the sides, or 11½ ft. at the middle, from the tops of the rails; the length of coal wagons is not to exceed 16½ ft. over head-stocks, though coke wagons may be 17½ ft.; the wheel-base is to be not less than 8 ft. or more than 9 ft.; the buffers are to be 5 ft. 8½ in. apart, centre to centre, and 3 ft. 5 in. above the top of the rails, and in every case are to be fitted with laminated springs, which must also be supplied to old wagons with wooden (springless) buffers when undergoing reconstruction; the rim or periphery of the wheels must be turned to a diameter of exactly 2 ft. 9 in., with a tire not less than 2 in. nor more than 2½ in. thick on the tread; and the coupling chains must be 1½ in. in diameter, instead of 1⅜ in. as formerly, to diminish trouble from their breaking under the strain of long trains. From the economic point of view, the most important question in connection with wagons is their

capacity, and their weight in relation to that capacity. The average capacity of the trucks used on British railways is well below 10 tons. In 1900 the average capacity of the London and North-Western's open and covered goods trucks was given as about 7 tons, although that company has many of 10-tons capacity, and has within the last few years built a number able to carry 20 tons. Coal and ore wagons have in general a rather larger capacity, ranging from 8 to 10 tons. The tare weights, that is, weights when empty, naturally vary with the mode of construction and the traffic for which the trucks are intended. In 1900 the average tare of the London and North-Western's open and covered goods wagons was computed to be 5 tons 6 cwt. 3 qrs.: on the one hand, 8-ton trucks belonging to it may be seen having a tare of over 6 tons, and, on the other, 20-ton trucks with a tare of only 7¼ tons. On the Great Western there are 10-ton wagons having tares of 5 tons, some more, some a few hundredweight less. On the South-Eastern and Chatham many of the same capacity weigh about 5½ tons or a little more; some old ones holding 5 tons weigh nearly as much as they carry. Many 10-ton private wagons weigh over 6 tons; the tare for them is now limited to 6 tons 2 cwt., and for 12-ton wagons to 6 tons 12 cwt. On the whole, it is probably true to say that an English goods train for every ton of its dead weight has a carrying capacity of less than two tons, and to put the ratio of capacity to dead weight at 2 to 1 is to take a favourable view of the situation.

In other countries wagons are used which have a considerably greater capacity in proportion to their

tare weight. In India, for example, there are four-wheeled open wagons which can take a load of 17 tons, and yet have only a tare of 7 tons. In America, where the freight stock universally consists of cars mounted on bogie trucks, the standard capacity has long been over 25 tons (tare about half), and at the present time hundreds of pressed-steel cars are being built which, with a tare of 40,000 lb., can carry 100,000 lb. or more. Hence, in the best American practice, the ratio of capacity to dead weight is 5 to 2, against the 2 to 1, or even 3 to 2, achieved in England. These figures plainly point to the conclusion that English railways are hauling considerably more dead weight, capacity for capacity, than is the case in some other countries; and since the haulage of such weight not only yields no revenue, but is an actual source of expense, they further suggest that economies might be effected by the introduction of wagons having a smaller proportion of dead weight to capacity. Another advantage which it is claimed would follow from such wagons is a reduction in the length of the trains. The more capacious the wagons, with a given wheel-base, of which a train capable of carrying a given load is composed, the shorter obviously its length, because the body of each truck is separated from its neighbour by a space of 3 ft. or 3½ ft., and the fewer these spaces the shorter the train. It follows that shorter sidings and sheds would be required for the accommodation of trains of a given capacity, or, alternatively, trains of greater capacity could be taken into existing sidings and warehouses.

In theory this argument in favour of high capacity

and relatively low tare weight is admirable. Unfortunately, however, it overlooks certain facts that are of essential importance in practice. To begin with, it derives its force from the assumption that the capacity of a wagon and the load it carries in actual working are convertible terms. In an ideal system of transportation this would be the case; the wagons would be of the largest possible size, and be built in the lightest possible manner; they would always be loaded to their full capacity; and every train would be made up of the full number of them that the locomotive could haul at the required speed. But no railway has yet been constructed on which such ideal conditions are attained, and managers of the non-ideal railways that do exist have to do their best with facts as they find them. If, at reasonable cost, they can regularly command goods in, say, 20-ton lots, then it will be to their advantage to use 20-ton trucks. But if they can only command 10-ton lots, there is obviously no economy, but rather an unnecessary expense, in employing 20-ton wagons weighing 7½ tons each, as compared with 10-ton wagons weighing 6 tons; and if the lots are still smaller, the wastefulness of the larger wagons, with their absolutely heavier tare weight, becomes still greater. For economical working it is necessary that wagons, built as light as possible, should be loaded as nearly as possible to their full capacity, whatever that may be; but if full loads cannot be obtained for small wagons, it is idle to talk of effecting economies by building big ones.

The most favourable opportunity for securing big loads occurs when large quantities of some particular

material have to be moved regularly from point to point. In Great Britain this condition is most nearly fulfilled in the case of coal and minerals, as when ore is conveyed from the mines or the sea to the furnaces, or coal to some great city like London for consumption or to the docks for export. In 1901 such traffic accounted for 298 million tons of the total of 416 million tons of goods traffic handled by the railways of the United Kingdom, though it only yielded £22,227,000 out of the £52,965,000 derived from the transportation of merchandise of every kind. Here there ought to be a field for any economies that are to be effected by the use of wagons of large capacity, for when such huge quantities are in question the saving even of a small fraction of a penny in handling each ton would mount up to a considerable sum. Yet we find that the great bulk of this traffic is conducted in little wagons holding 10 tons or less. It is true that many of the railway companies are experimenting with bigger wagons. The Caledonian and Great Eastern Companies, for example, are using them for their locomotive coal; the Furness Company has some 40-ton ore wagons; the North-Eastern has obtained such satisfactory results from large trucks in the carriage of coal between the collieries and the Blyth and Tyne docks that at the beginning of 1903 it had on order fifty steel bogie wagons, 39 ft. long, 8 ft. wide, and 10 ft. high from the rails, able to carry 40 tons of coal, with a tare of about 16 tons. But, in spite of these and other examples that might be cited, the number of large wagons employed remains insignificant

beside the million or so of small ones in regular use.

In attempting to account for the comparative neglect of large wagons for mineral traffic in Great Britain, in face of the arguments that can be adduced in their favour, two lines of explanation are open. We may either dispose of the matter with the simple affirmation that British railway managers do not know their business; or we may consider whether there are not circumstances which detract from the advantages to be derived from the general introduction of such wagons, or even render it impossible altogether. Reasonable people will agree that recourse should not be had to the former method of explanation until the latter has been tried and found wanting.

Now, although large quantities of minerals are carried, sometimes in big consignments, the average consignment on British railways is smaller than is generally realised. The London and North-Western's lines penetrate to almost every quarter of England, and that company may therefore fairly be taken as supplying experience typical of the general conditions of traffic. On its system, according to the statement of its chairman, Lord Stalbridge, made at the general meeting of the company in February 1903, although the largest consignment of coal is nearly 1000 tons, the average is only 17½ tons, while 80 per cent. of the consignments it receives are of less than 20 tons. For the transportation of this 80 per cent., on the principle advanced above, wagons of a capacity exceeding 20 tons would present no advantage, while for many of the consignments, which run so low as

2 tons 14 cwt., 10- or even 8-ton wagons would be too large, for it must be remembered that to mass two or more small lots in one truck, and thus make up a good load, would be a very difficult thing to carry out in practice, if only owing to the necessity of keeping the different consignments separate.

There is, however, a residue of 20 per cent., which is received in lots of over 20 tons. Why, it will be asked, should not large wagons be used for its conveyance? The reason is, in great measure, lack of accommodation for such wagons at places of loading and unloading. Weigh-bridges, sidings at collieries, the arrangements for filling the trucks, the tips and other appliances for emptying them at docks and depôts, have all been designed for wagons holding 10 tons or less, and in consequence there are not, at the present time, very many places where large wagons can be dealt with at all. Of course it would be possible, in an engineering sense, to change this state of affairs, and modify the arrangements so that large wagons could be accommodated. But wholesale alterations of this character would involve the expenditure of a great deal of money, and before they were undertaken it would be necessary to make certain that they would pay; in other words, since it is not business to spend one shilling in order to get sixpence, that the interest on the sum spent in executing them would not exceed the saving effected by the use of the large wagons. To settle this question satisfactorily, definite information is needed as to the cost of such works on the one hand, and the

economies to be effected in transportation on the other; and this is not available.

Even if the answer were favourable to the change, a further difficulty remains. Who is to pay for the alterations? The solution is easy where the wharves, etc., are owned by a railway company: since it would reap the benefits that might accrue, it would naturally be expected to defray the expenses. But in the more numerous cases in which they are the property of other traders, whether individuals or corporate bodies, it would not be reasonable to ask the owners to spend money on works from which they themselves would gain little or no advantage; yet a railway company, or anybody else, would properly hesitate before sinking its money in other people's property, not in its own possession or even under its own control. But, although the traders could not fairly be called upon to effect a general and immediate reconstruction, it may be hoped that, as existing works gradually come to need renewal, they will take the opportunity of rebuilding them in such a way as to render them available for larger wagons than are now usually employed. If the change were effected in this manner, the burden of the cost would not be felt very severely, and a way would gradually be opened to economies in transportation which, although not universally practicable, might undoubtedly be attempted more frequently than in the past, and which, if realised, might be of indirect benefit to the whole trade of the country.

In discussing the question of big wagons for coal traffic, it must be remembered that, to a very large

extent, the matter is in the hands of the coal merchants, who not only determine the size of the consignments, but also own or hire many of the wagons in which they are conveyed. Of these "private" wagons, more than half a million are regularly running on the railways of Great Britain; and some of the companies—even those that have a large coal-carrying traffic, such as the London and North-Western and the Great Western—possess comparatively few coal wagons of their own. In these circumstances, the railways are scarcely masters in their own house, so far as coal traffic is concerned. It is true that, as has already been explained, they exercise a control over the constructive details of private wagons, and refuse to allow them to run if they are not in proper repair; but they have no power to dictate minimum loads (though they do fix the maximum capacity at 20 tons). Hence, if a coal merchant chooses to put a load of 5 tons in a truck designed to hold 10, they have no choice but to haul it, together with the 5 or 6 tons of dead weight represented by the truck itself, without obtaining any higher rate per ton than they would if the truck were full and the proportion of paying load to dead weight 2 to 1 instead of 1 to 1.[1]

Further, the rate for carrying coal in private wagons includes not only its conveyance from the point of loading to that of unloading, but also the return journey of the empty truck. It follows that, supposing a coal merchant receives an order for

[1] If, however, the consignment weighs less than 4 tons, they may charge as for 4 tons.

4 tons of coal and chooses to dispatch it, as he perfectly well may, in a 10-ton truck having a tare weight of 6 tons, what the railway actually carries for its money is 4 tons of paying load plus 6 tons of dead weight on the outward journey, and 6 tons of dead weight on the return journey; that is to say, to earn the price of carrying 4 tons of coal, it is obliged, through no fault of its own, to haul 12 tons of dead weight, which not only brings in no profit, but actually involves expense in wear of permanent way, locomotive fuel, etc. Of course, if the wagon carries a load on its return journey, that has to be paid for, but the power to load it does not rest with the railway company, but with the consignor and consignee.

In certain other respects, these private wagons are not an unmixed blessing to the railway companies. No doubt, they save the latter a certain expenditure which would otherwise be incurred for rolling stock, and thus tend to keep down capital outlay—outlay, moreover, which in times of depressed trade might be unremunerative. On the other hand, the cost of sorting and marshalling them for return to their "homes" is a considerable item, apart from the empty haulage mentioned above. An ordinary truck, owned by a railway company, which has been sent with a load from station A to station B may be worked on to station C, station D, and so on; a trader's wagon must be returned forthwith from B to A. Some day, too, possibly, the existence of privately owned wagons may be forced unpleasantly upon the notice of the ordinary citizen through his pocket, for it may occur to some enterprising person, at a period of brisk trade,

to form a corner in them, and then charge extravagant rates for letting them out. If that were done, and if the railway companies could not supply the demand with their own trucks, the result would be a rise in the price of coal, and the consumers, as usual, would pay. Be that as it may, however, traders in this country have a statutory right to run their own vehicles over the railways, and the coal dealer who enjoys this right together with other traders is as little likely to forego it as he is to abandon the practice of putting little loads in little trucks, when from experience he finds them most suitable for the purposes of his business.

In the case of general merchandise the antagonism between cheap railway transportation and retail trading is even more pronounced than it is with the coal traffic, and the prospect of anything like wide employment of large wagons seems correspondingly remote. The average load per wagon attained in general goods working, apart from minerals, at the present time probably does not exceed 2 tons, and to carry such weights the ordinary small wagons of 10-, 8-, or even 6-tons capacity are obviously more than adequate, though it must be remembered that many articles of commerce are very bulky, and therefore require much more room for stowage than, say, a consignment of coal or ore of the same weight. The main reason why the average load is so small is because the British trader is accustomed to send his goods about in multitudes of small lots. For example, on the Great Eastern, 70 per cent. of the consignments of the general goods traffic weigh 3 cwt. or less, and consignments of 1 ton or less account for 90 per

cent. of the total. On the London and North-Western the statistics of the goods received for dispatch from Broad Street goods station show that the average weight per package is only 2 qrs. 16 lb., and per consignment 3 cwt. 3 qrs. 22 lb. On one day it was found that the packages numbered 23,067, and were addressed to 720 different stations. Their total weight being about 900 tons, the average weight of each was well under 1 cwt. These 23,067 packages were loaded into 379 wagons, each of which thus carried on the average 2 tons 7 cwt. 3 qrs. This result may not seem a very wonderful one, but it is better than the general average attained with "shed-traffic." It was rendered possible by the fact that at Crewe the London and North-Western has a large "tranship shed" to which goods can be sent in full wagon loads, and then be re-sorted and combined so as again to give good loads on to their various destinations. Except for this arrangement, the North-Western would have been obliged to follow what, broadly speaking, and apart from small packages which a man can readily lift out of a "roadside van" while the train is standing at a platform, is the general practice of loading the goods into as many wagons as there are destinations; this, in the above case, would have meant the employment of 720 wagons, with an average load of 1¼ tons. The expense of maintaining and working such sheds is very considerable, for goods require men and machines to handle them, and do not, like passengers, move themselves at junctions from one train to another without cost. Unless, therefore, there is a dense traffic to be served, the economy to be

effected must be doubtful. Crewe, it may be noted, is exceptionally well suited to be the scene of such a process of transhipment, by its position at the junction of important through lines from London, South Wales, North Wales and Ireland, Liverpool, Scotland, and Manchester, and it is scarcely too much to say that no other railway company in this country possesses a centre that could offer equal advantages for a similar purpose. That is, doubtless, the reason why the Crewe institution stands unique, though a scheme is in contemplation to establish something of the same kind at Carlisle, where seven different railway companies exchange traffic.

But besides sending his goods in small quantities, the British trader desires them to be dispatched promptly and carried quickly, though he is not always so anxious for haste in unloading after the wagon has been delivered. Here is another factor that has an important influence in keeping down wagon loads. In America, goods intended for a given destination are often allowed to accumulate at the dispatching station until they are sufficient to form a good load; in England, it is the aim to send them off on the day on which they come into the railway's hands, irrespective of quantity. This practice of itself is in many cases sufficient to preclude the possibility of a good load, even in the present standard wagons, much less in wagons of higher capacity.

To sum up, so far as the possibility of employing large wagons is concerned, goods traffic may be divided into two classes. In one, some of the consignments are so large that large wagons could be

advantageously used were adequate accommodation for their loading and unloading generally existent; in the other, the consignments are mostly so small that the present small wagons are quite large enough, if not too large. In both classes the hope of a change being found possible, lies very largely with the traders who dispatch and receive the goods. If, in the one case, they will remodel their terminal facilities so as to enable large wagons to be dealt with, and in the other will mass their goods so as to make up consignments of respectable size, or will agree to be content with slower conveyance so that the railways may be able to do so for them, then the way will become clear for a general increase in the capacity of the wagons used on our railways. The process of increasing the weight of consignments must, however, go on for a considerable time before the capacity of the present wagons will be exhausted, though it can scarcely be doubted, especially in view of what has been effected on some lines of recent years, that there is still room for a substantial improvement in the average wagon-load, even in existing conditions.

An obvious extension of the principle that the load of each wagon should be as large as possible—in other words, that the number of wagons employed in conducting a given volume of traffic should be a minimum—is that the number of trains run should be as small as possible. To secure this, it is necessary that each be as long and as heavy as is compatible with the power of the engine employed in relation to the speed required and the character of the road. Large trains make for economy in two ways: they

reduce operating expenses, and they allow of a larger traffic being carried on in a given time over a given line than is possible with small trains. Every train, whatever its size, requires at least one engine-driver, one fireman, and one guard. Suppose, for the sake of illustration, a rather extreme case, in which four trains, each of ten trucks, and each having one engine and one guard, are combined into a single train of forty trucks drawn by one engine and attended by one guard. Then, in the first place, the wages of nine men will be saved. In the second, the single train will require less coal, water, oil, etc., for its engine than would the four for their four engines; it will cause less wear to the permanent way, over which only one engine will pass instead of four, the engine being always the heaviest part of the train; and it will also cause less wear to the outdoor points and signals, and to the electrical signalling apparatus, which will need to be manipulated only once instead of four times.

If a wholesale reduction in the number of trains could be effected on any railway on this scale the results would be far-reaching, and might even make themselves felt in the salary list of the higher administrative officers. The second advantage of long trains —that of enabling more traffic to be carried—only becomes of practical importance in very busy stretches of line; but it is easy to see, since, in the British system of signalling, only one train, whether it consists of a light engine or a string of fifty trucks, is supposed to be in any block section at a time, that the longer each individual train the greater the total number of trucks that can be simultaneously accommodated

by the line. These arguments apply, whether the trucks are empty or well filled, but, of course, the better they are loaded the more the profit to be derived from hauling them. Long trains of fully-loaded trucks are the ideal, but a long train of partially-loaded trucks is better than a short one; and while the movement of empty trucks merely entails unproductive expenditure, the larger the number of empty trucks that are grouped into a single train the less that expenditure is likely to be.

But although the conditions of economical transportation are fairly plain, their realisation is by no means a simple matter. The best results are obtained with mineral traffic. In the year 1891 the general manager of the London and North-Western (Sir George Findlay) stated that about thirty-five trucks, holding 8 tons each, constituted the average load of a coal train. Since that time weights have increased, and now coal trains of fifty loaded wagons (say 500 tons of coal and 250--300 tons dead weight) may be met with. Still such large trains are not, and perhaps never can be, the general rule. They may be obtainable in cases where there is a heavy traffic between one producing area and another big distributing centre, but that is far from happening always. Even when it does happen, not only is there the expense of collecting the wagons from the collieries adjacent to the starting-point and marshalling them into one train, but as soon as the distributing-point is reached the big train must be broken up into smaller trains, which at once bring down the average of the train-load. There is another factor

almost constantly at work to reduce the average load —one, moreover, which would operate if not a single ton of coal ever left a colliery except as part of a 500-ton lot loaded in fifty 10-ton wagons. Mineral traffic, whether coal or ore, is nearly always in one direction only, and in general nothing can be put in the wagons to give them a paying load for the return journey, which accordingly they make empty. This result, as already shown, is largely due to the system of privately-owned wagons prevalent in this country; but, apart from that, it could never be entirely avoided, simply because the amount of goods to be moved in the two directions is not equal. For instance, at the chief London goods depôt of the London and Brighton Railway at Willow Walk, the average daily tonnage dealt with is 630 tons inwards and 1450 outwards. This means that, unless by some miraculous dispensation the goods coming to London are rather more than twice as bulky as those going away from it, trucks must constantly be travelling up to Willow Walk either quite empty or only partially loaded, even supposing they are always fully loaded out of London. In the United States, for the year ending 30th June 1901, the mileage of empty freight cars was 3,921,979,019 miles against 8,889,232,684 of loaded cars, or just over 30 per cent. of the total freight-car mileage.

To give some idea of the train-loads actually realised in working coal traffic in this country, reference may be made to the North-Eastern. This railway is favourably placed in many respects; it does a huge trade in coal—bigger than that of any other

British railway, so far as number of tons handled is concerned, though second (in 1901) to the Midland in point of gross receipts derived therefrom—much of which is sent in big lots down to the sea-board to be shipped, and it has a pretty complete monopoly of its district, so that it is free to load and make up its trains in the most advantageous manner, without being troubled by any fears that a little delay may result in a competitor getting ahead of it. Its management, moreover, is keenly alive to the desirability of reducing operation expenses by adopting the most approved methods of handling freight, and for several years it has enjoyed the use of engines able to haul 1000 tons comfortably. Yet, according to the figures it prepared itself, the average load of its mineral trains in 1900 was only 92·49 tons. If allowance be made for the fact that in this calculation empty mileage is included, it may be said that each of its loaded coal trains carried 185 tons; or, in other words, that each on the average consisted of less than twenty wagons, and weighed gross about 300 tons. Since 1900, however, the results have materially improved. In the first half of 1902 the average load carried by each mineral train for every mile it ran was 106 tons, which in the second half of the year increased to 113 tons. The average for the year was thus 110 tons, or, ignoring empty mileage, 220 tons, equivalent to trains of twenty-two standard wagons weighing gross 330 or 350 tons. In the first half of 1903 the average mineral train-load increased still further to 121 tons. Yet, in spite of all the efforts made, it is plain that the trains which attain

a gross weight of 1000 or even 700 tons must be somewhat infrequent, although the hauling power of the best engines possessed by the company has lately increased by roughly 50 per cent. to a maximum of nearly 1900 tons on a level road at 15 miles an hour.

Ordinary merchandise trains are in general lighter than loaded mineral trains—on the one hand, because of the physical reason that they travel somewhat faster, and, on the other, because the difficulties of fully loading them are greater. In spite of their smaller loads, however, they are more profitable, because, for one thing, they are more or less loaded in both directions. In 1891, in his evidence before the Parliamentary Committee on railway rates, Sir George Findlay stated that an ordinary merchandise train, as dispatched from London on the London and North-Western, consisted of about forty wagons,[1] with rather under 3 tons in each; the trains, therefore, carried 100 or 120 tons of paying load, and weighed 300 or 350 tons in all. In passing, it may be noted that this figure of Sir George Findlay's for the average load of trucks out of London is somewhat higher than that stated by Lord Stalbridge to have been attained, apparently for the same traffic, in 1902. On the North-Eastern in 1902, according to the calculations worked out by its own staff, the average load per train-mile was 58 tons: on the assumption that each wagon contained on the average 2 tons of paying load, the average number of wagons per train must have been twenty-nine, and

[1] Trains of sixty vehicles, drawn by one engine, may now be seen travelling between London and Rugby.

the total weight of the trains from 200 to 230 tons. At first sight the present achievements of the North-Eastern do not seem to compare very well with those of the North-Western twelve or thirteen years ago, especially as the former now enjoys much more powerful engines than the latter had then. It must be remembered, however, that the figures for the North-Western refer solely to its main trunk line, whereas those for the North-Eastern include also its least profitable branch lines, some of which perhaps do not directly yield enough to pay working expenses.

Small branch or agricultural lines have, indeed, a good deal to answer for in keeping down the average train-loads of British railways. Suppose a branch line to Mudton-in-the-Hole, 10 miles from the main line, and suppose further that the imports of the place are provided for by the aid of ten wagons a day: these, collected from various stations round, say, London, form part of a fifty-wagon train as far as the junction for Mudton. Being detached there, they are sent on immediately to that interesting little place, whose inhabitants from long custom have come to regard daily communication with London as their right. If this right had never been conceded, it might be possible to hoard the wagons at the junction for a few days, and then send them on as a good train of forty or fifty wagons; but, as it is, the result is the appearance every day in the railway's train-load statistics of 10 train-miles with a load of, say, 20 tons a mile. But perhaps Mudton's exports weigh much less than its imports, *e.g.*, 75 per cent. less. If that is so, its total daily contribution to the statistics of the railway

will be 20 train-miles with an average load per mile of 12½ tons. But that is not all. The main line train, which started from London with fifty trucks, or a load of 100 tons, after the junction for Mudton pursues its journey with a load of only 80 tons. Similarly, some train proceeding to London will have to be made up at its starting-point, on the assumption that at Mudton junction it must pick up ten trucks containing 5 tons, and therefore its train-load average will also be reduced. The above is, of course, an extreme case, both as regards its figures and its simplicity, but it illustrates the principle of the difficulty with which traffic managers have to contend in obtaining good loads on their trains. Even the supposition that the main line trains from and to London consist of the maximum complement of trucks is more than can properly be conceded, and it often happens that a direct and immediate service must be given to a place the goods consigned to which form far less than a train-load.

The maximum weight of the trains permissible on any given line depends on a variety of factors—among them being the power of the engines employed, the rate of speed required, and the character of the line as regards gradients and curves. The length of the train must also be taken into account in some instances, for it must not be so long as not to go into the refuge sidings or as to foul two junctions simultaneously—contingencies that occasionally arise. The engine-power, speed, and gradients and curves are connected quantities. The higher the speed, the smaller the load that can be hauled by a given locomotive; and the steeper the

gradients and the sharper the curves, the smaller the load that the engine can manage, or the lower the speed at which it can travel. Thus an engine which could take a certain load at a certain speed over a level railway like the Great Western out of London would be incompetent to work similar loads over the heavy gradients of the Lancaster–Carlisle section of the London and North-Western. Practically, however, engine power is the most important factor; and it is probably fair to say that until recently its development lagged behind that of the traffic, so that the larger loads which would have conduced to economy of working were impossible, or, if they were attempted, it was at the expense of employing two engines on one train. The last few years, however, have witnessed an important growth in the power of goods engines, and a good many of the most recently constructed locomotives are about as big as it is possible to make them, in view of the limitations imposed by the "clearance gauge" of British railways, and by the fact that many of the older bridges, which, however, are gradually being reconstructed, are scarcely strong enough to bear the heavy axle-weights involved in engines of the largest size. Very powerful goods engines, running on eight wheels, all coupled, and with axle-weights of 12 to 15 tons, or a total of 50 or 60 tons on the four axles, are now being worked by several companies—*e.g.*, the Lancashire and Yorkshire, the Great Northern, the North-Eastern, the Caledonian, and the London and North-Western, the last-named having begun to build them so far back as 1892, and, by their aid, trains weighing 1000 tons or more are rendered possible.

Engines of this type on the North-Eastern can haul 1897 tons on the level at 15 miles an hour, or 1689 tons at 20 miles; and one of them succeeded in drawing eighty-one loaded trucks weighing over 1300 tons up a bank rising 1 in 108 on a sharp curve.

Such performances, of course, would not be regarded as very remarkable in America, where 2000 tons is not an uncommon load, and there are engines capable of drawing 3000 tons or more. It may be doubted, however, whether the mechanical problem of working such exceedingly long trains has yet been mastered sufficiently to render them acceptable in this country, even if there was a demand for them and engines could be built to haul them. Even in America, where the standard of safety is not so stringent as that prescribed by the British Board of Trade, it is admitted that existing methods of coupling and of braking such long trains are not all they might be. Under the enormous strains set up, the "knuckles" of the automatic couplers give trouble by snapping, and some railways, *e.g.*, the Pennsylvania, have thought it advisable to go to the expense of fitting wagons with special "draught gear" designed to minimise the shocks and strains to which the couplings are subjected when a long train is being either started or stopped. Again, adequate brake-power is of essential importance on such trains, and it is often taken for granted that in America this is satisfactorily supplied by means of continuous brakes. That, however, does not seem to be the opinion of every American railroad manager, for, though the majority of the cars are fitted with the continuous brake, one may frequently see trains in

which the brake apparatus of the first fifteen or twenty vehicles only is connected with the engine, the remainder of the vehicles to all intents and purposes not possessing a continuous brake at all. On coming down an incline, the train is controlled by a number of brakesmen, who run along the tops of the cars and screw down hand-brakes when required. This neglect, and presumably, therefore, distrust of the continuous brake on long freight-trains, is not confined to second- and third-rate roads, on which equipment may be supposed to be somewhat inferior; on the contrary, even on a first-class line like the New York Central, close to New York the passenger may notice near every overhead bridge a kind of rough tassel of cords, familiarly known as a "tickler," which hangs down over the track at about the level of the tops of the cars, and is intended to warn a slumbering brakesman of an approaching bridge. Obviously, if there were no brakesmen on the tops of the cars, there would be no need for such warning devices. It is probably only because overhead bridges are infrequent on American railways that the number of trainmen killed in 1901 through "overhead obstructions" was only 48 out of a total of 1537 killed by all causes, the number of injured being 457 out of 16,715.

CHAPTER IX

GOODS RATES.

Excessive Charges—Caution required in comparing British and Foreign Rates—Differential Rates—Undue Preference—The Basis upon which Rates are fixed — What the Traffic will bear — What the Traffic will not bear.

No subject in railway economics has provoked more discussion than the question of the rates charged for the conveyance of merchandise traffic and the proper principles upon which they should be based. So far as passenger fares are concerned, the railways have been subjected to comparatively little interference either from Parliament or the law courts. But with goods traffic the case has been different, and from an early period of their existence they have had to face periodical outbursts of popular dissatisfaction which have left more than one mark on the Statute Book. That there should be this difference is not surprising when it is remembered that the transportation of merchandise from place to place—a matter which in this country is largely in the hands of the railways—is of vital importance, not merely to producers and traders, but also to the whole community as consumers. If all passenger trains ceased to run and people were prevented from travelling about, enormous

inconvenience would certainly be caused, but business would not necessarily be brought entirely to a standstill, though it would be conducted under very serious difficulties. If, however, all goods traffic was interrupted, the result would be an immediate and extensive collapse of trade and industry, and in a very few days the inhabitants of many of our large towns would find themselves in want of food. The comparative unimportance of passenger traffic from this point of view is doubtless one of the reasons why it has escaped the attentions which have been showered upon goods rates.

The complaints that have been levelled against railway companies on the score of their goods rates fall into two main classes. It is said, in the first place, that they make excessive charges, and, in the second, that they quote preferential rates, thus giving one place or district, or even individual, an unfair advantage over another, just as their caprice dictates. Space will not allow of more than a cursory examination of the large field that is opened up by both these allegations.

The maximum charges permitted to British railway companies were all laid down with great particularity by Parliament in 1891–92, after a protracted inquiry. Few rates that were intrinsically unreasonable or excessive ought then to have escaped the vigilance of the Board of Trade and the traders, considering the ample opportunity they had enjoyed of stating their views, but, to make sure, any increased rates that were allowed the railways in those years were practically annulled in 1894. (See next Chapter.) More than that, the statutory maxima are in many cases

inoperative, for there are thousands upon thousands of rates in actual operation which are less than those authorised by Parliament; some of the companies, in fact, claim that rarely, if ever, do they charge the full amounts to which they are statutorily entitled. Of course it is possible, perhaps probable, that every company occasionally makes its clients pay more than it has any right to ask, but an occasional and accidental overcharge cannot fairly be construed into the habitual and systematic extortion which railways are now and then accused of practising.

Should, however, any substantial ground arise for such an accusation, Parliament has not left the sufferers without remedy. Section 31 of the Railway and Canal Traffic Act, 1888, provides that, if a man thinks a railway is charging him at an unfair or unreasonable rate for the goods he sends by it, or is in any way treating him in an unfair or unreasonable manner, he may complain to the Board of Trade, and that Department, if the complaint seems reasonable, will call upon the railway for an explanation of its action. Further, the Railway and Canal Commissioners, by section 10 of the same Act, are empowered to hear and determine any dispute as to the legality of any toll, rate, or charge for merchandise traffic, and to enforce payment of so much as they decide to be legal.

Complaints of excessive rates, however, more commonly take the form of assertions that the charges of British railways are higher than those of foreign countries, and that they constitute an undue tax on British industries. In considering statements

of this kind, the great difficulty is to make sure that the charges which are being compared are for services which are fairly comparable. It is quite easy to find classes of goods which, on the face of the published rates, are carried more cheaply in America than in Great Britain; but that fact is not in itself sufficient to prove that, for equal services, American rates for those goods are lower than British ones. A British farmer, reading that in the United States wheat is conveyed to the sea-board for a fraction of a cent per ton per mile, may be tempted to think himself ill-used because he has to pay several pence per ton per mile for the conveyance of a few sacks of Indian corn from a neighbouring town; but he conveniently forgets that in America a single ton of wheat would never be carried at these very low rates, and that in England he could get his corn conveyed more cheaply if he chose to order it in fairly large quantities. In every country the carriage of small quantities over small distances is proportionately more expensive than that of large quantities over long distances, for the simple reason that the cost of the service is greater; and seeing that Great Britain is pre-eminently the country of the retail dealer, whose consignments are to be measured in hundredweights rather than in tons, and that its size prevents the possibility of the goods being sent anything but short distances, it would be in the last degree surprising if the average charges did not work out greater than in America, where the bulk of the traffic with which the railroads have to deal is consigned to them in large lots for conveyance over long distances.

Another point which must be attended to in endeavouring to make comparisons between different countries is that, in Great Britain, rates in very many cases include subsidiary charges, as for collection and delivery, whereas in other countries they frequently do no more than cover the cost of carriage from station to station, terminal services involving an additional charge. In America, for instance, such services are largely performed by the "Express Companies." When a man wishes to send a small consignment he employs one of these companies, and therefore has to add the by no means insignificant charges made by it to those made by the railroad, in order to discover what the transportation of the consignment has really cost him. On the Continent a similar system is in existence: forwarding agencies, independent of the railways, collect the goods, load them on the trucks, and deliver them, of course charging the public for the services they perform. The same arrangement, it may be noted, was common in this country up to the middle of last century. Originally, the function of a railway company was regarded as being simply to provide a railway, which anyone might use on payment of tolls. Then the conception widened, and the companies began also to provide the trucks and the engines to haul them, but still were not carriers; the collection of merchandise for conveyance, the warehouses to which it was brought, the staff which loaded it into trucks and did all the necessary bookkeeping in connection with it, were in the control of private firms, which, on the one hand, paid the railways for the use of their lines

and rolling stock, and, on the other, exacted from the public charges which yielded a handsome profit in addition to covering the railway tolls and charges, and the expense of providing station accommodation, horses and carts, clerks, etc. The third and present stage was reached when the railway companies took upon themselves all the "services incidental to the duty or business of a carrier," and claimed the right to make a separate and additional reasonable charge in respect of such services.

A third factor which should be considered in comparisons of railway rates is the speed at which the goods are conveyed, and the extent to which the railways assume liability for delay in delivery or damage *en route*. The more promptly a consignment of goods is delivered at its destination, the greater in general is the cost to the carrier, and the more valuable the service rendered to the sender and receiver. Hence, even when more is charged in one country than in another for conveying a certain quantity of a certain kind of goods over a certain distance, the same terminal charges being included (or excluded) in both cases, it does not necessarily follow that the rates, although higher, are dearer, since it may be that for the higher charge more is given in the way of quicker transport.

To give anything like a satisfactory answer to the question, Are railway rates, on the whole, dearer in England than in other countries? would require an examination far too long and detailed to be attempted here. The difficulties of such a task may, however, be illustrated from a correspondence which appeared in *The Times* in the year 1902 between Mr. G. S. Gibb

of the North-Eastern Railway and Mr. M. B. Wied of the Baltimore and Ohio Railroad. The former, on 20th June, stated that, "for the quantities in which English traders actually consign their traffic and for usual English distances, English rates are lower than American," and in proof of this proposition he gave side by side the American and English rates per ton for conveying a consignment of 5 tons (delivery and collection being excluded) between two stations 42 miles apart, the illustrations being drawn from the ordinary scale rates of the North-Eastern and of "one of the largest railway corporations in the Eastern States of America." A month later (27th July) Mr. Wied affirmed that, although the figures Mr. Gibb gave as American rates do exist in American rate tables, they only apply to sparsely settled districts of limited area, and that "in much the larger portion of the territory extending longitudinally from the Atlantic

Commodity.	American Rates, as per Mr. Gibb.		American Rates, East of Ohio River.		American Rates, West of Ohio River.		English Rates.	
	s.	d.	s.	d.	s.	d.	s.	d.
Bricks (common)	12	2	...		...		4	6
Bricks (loose or in bundles)	...		10	10	8	4	...	
Bricks (in barrels or boxes)	...		6	8	6	3	...	
Cement	8	5	7	6	6	8	5	10
Flour in sacks	7	6	6	8	6	3	6	8
Malt in bags	7	6	6	8	6	3	7	1
Oilcake	7	6	6	8	6	3	6	8
Potatoes in bags	8	5	7	6	6	8	6	8
Plates and Bars	8	5	7	6	6	8	5	0
Stone (rough building)	8	5	6	8	6	3	4	2
Ale	12	2	10	10	8	4	10	0

Coast to the Ohio River, thence to the Mississippi River, and latitudinally from the Great Lakes to the south-west bend of the Ohio River, American rates for less than car-load lots do not make anything like so unfavourable a comparison with English rates as those given by Mr. Gibb." He added the foregoing table, which combines the figures given by Mr. Gibb with the rates that "apply to fully 90 per cent. of the business carried in small lots in the above referred to territory for distances of 40 up to 50 miles."

A day or two later a second communication appeared from Mr. Gibb accepting Mr. Wied's letter as substantially confirming his conclusion. This, however, was not exactly Mr. Wied's view of the situation, and on 2nd September another letter appeared from him, in which he suggested that Mr. Gibb's comparison was "between American less-than-car-load and English car-load rates, *i.e.*, American maxima with English minima," and gave the following table comparing American car-load rates with English car-load rates, according to Mr. Gibb, for a distance of 50 miles:—

	English.		American.	
	s.	d.	s.	d.
Bricks	4	6	2	11
Cement	5	10	4	2
Flour in sacks	6	8	4	2
Malt in bags	7	1	4	2
Oilcake	6	8	4	2
Potatoes in bags	6	8	6	3
Plates and Bars	5	0	5	0
Stone (rough building)	4	2	3	1½
Ale	10	0	6	3

Further, he gave, in the following table, the actual revenues per ton-mile realised by the Baltimore and Ohio Company on the staples mentioned for several months, compared with the revenues per ton-mile that would be realised on traffic carried at Mr. Gibb's American rates, adding also a comparison of average hauls to show that "length of haul is very far from being as potent as the scale of charge in pulling down the rate per mile":—

	Mr. Gibb's Figures.		B. and O. Actual Figures.	
	Haul in Miles.	Rate per Ton-Mile.	Haul in Miles.	Rate per Ton-Mile.
		Cents.		Cents.
Bricks . .	50	5·84	124	0·604
Cement . .	50	4·04		
Flour . .	50	3·60	379	0·322
Malt . . .	50	3·60	401	0·349
Oilcake . .	50	3·60	334	0·399
Potatoes . .	50	4·04	299	0·869*
Plates and Bars .	50	4·04	193	0·633
Stone . .	50	4·04	126	0·462
Ale . . .	50	5·84	224	0·976†

* Includes receipts on fruit.
† Includes receipts on wines and liquors.

Yet, on 5th September, Mr. Gibb appeared again, perfectly impenitent, in spite of all these figures, as well he might be, since they did not affect his main contention; and on 15th September he was confirmed by Mr. W. M. Acworth, who is by no means a thick-and-thin supporter of British railways and their methods, in these words:—

"As for America, where, if anywhere, average rates are low, Mr. Gibb has recently shown to demonstration in your columns that rates for small consignments carried short distances—the only rates affecting the English small farmer—are much higher in the States than in England. The Prussian Government railways obtain about 2·10d. per ton per mile, the Austrian about 1·75d. for small consignments of agricultural produce. It is pretty certain that English railways do not obtain so high a rate, in spite of the fact that their average haul is less than half as long. I submit that all the evidence available as to English rates—and that the evidence is sadly inadequate I would be the first to allow—goes to show that the small farmer pays for the service he gets from the English railway companies not too much, but too little. He demands a shockingly expensive service; he sends his beef in hundredweights, his wheat in ton lots, his butter in pound baskets. Compared to his Continental or American rivals, who have learnt to do their business on modern lines, he pays a high rate. But the service he requires is so extravagantly costly, that, even at that rate, the railway companies would probably be better without his custom altogether."

To come to differential rates, the second iniquity which some critics attribute to British railways: the term is used to cover a good many things, and in its essential meaning might cover a good many more to which it is not usually applied. It might quite well be employed to designate the general practice of charging less per ton per mile for goods which are conveyed long distances than for those which are

conveyed shorter ones. In this sense differential rates are opposed to equal mileage rates, the advocates of which hold that the just and proper way of calculating railway rates is to charge so much per ton for each mile over which the goods travel, no matter whether the distance be 5 miles or 500. In another sense, the term might stand for those rates which would obtain if cost of service were taken as the exclusive basis of railway charges. On this principle, since the cost of conveying equal weights of a heavy article like coal and a light one like feathers must be different, the rates would also be different. But the expression is generally used as equivalent to preferential rates, with the implication that one locality or class of traders or individual is being given an advantage — probably unfair — as against another locality or class of traders or individual. For instance, if the produce of a manufacturing town A is carried by one railway to a port B 70 miles distant, at the same rates as by another railway to a port C only 50 miles distant, the latter feels itself aggrieved as being the victim of a preferential rate which is destroying the advantages of its geographical position. Or if the farmers in a grazing district find that trainloads of meat from abroad are conveyed to London, from a port more distant from London than they are, at a lower rate than they are charged for their consignments of a dozen or two carcases, then remarks are likely to be heard about a base conspiracy of the railway companies for the preferential treatment of the foreigner as compared with the native.

It may be noted that all these forms of differential

rates have been considered to a greater or less extent in the legislation which regulates the charges of the railways of this country. The theory of equal mileage rates has over and over again been examined and found wanting by Parliamentary Committees and Royal Commissions as unfair to the railways and bad for the public interest. Its rigid adoption would involve the abolition of all distinctions, so far as charges are concerned, between an easy cheap line and a difficult one, expensive to build and expensive to work; it would mean the discontinuance of competitive services between hundreds of places, since the shorter route, being obliged to charge the lower rates, would get the bulk of the traffic; and it would mean the discontinuance of much long-distance traffic, since the piling up of the mileage charges would put a prohibitive expense on its movement. None of these things is for the public benefit, yet any attempt to mitigate the disadvantages of an unbending application of the theory involves the introduction of differential rates, which, in fact, have been found unavoidable, even in cases where the principle of equal mileage rates has been ostensibly adopted.

Cost of service, again, is admitted in British railway legislation as a cause of differential rates. No attempt is made to use it as the basis upon which rates are determined, for the good reason that for any particular sort of goods it is impossible to discover with any precision what is the cost of carriage; but, in a general way, it is obvious that the cost of working a hilly line, like the Lancaster and Carlisle section of the London and North-Western, must be abnormally expensive,

and therefore a rather higher scale of charges is allowed, as is also done for specially costly works, such as the Runcorn Bridge or the Severn Tunnel. Cost of service is further recognised in the classification of goods into different classes with different rates; and, roughly speaking, on merchandise which is light and bulky a higher rate is allowed than on heavy articles that take up a small space in comparison with their weight. But here another principle comes into play —that of charging according to the value of the articles carried; and just as the Government exacts a higher percentage in death duties from the millionaire's estate than it does from the poor man's, so too the railways get more for carrying, say, a ton of bullion than for a ton of coal.

With regard to preferential rates, the guiding rule is not that they shall not exist, but that there shall be no "undue preference." Section 2 of the Railway and Canal Traffic Act of 1854, which reappears in the Act of the same title passed in 1888, forbade a railway company to "make or give any undue or unreasonable preference or advantage to or in favour of any particular description of traffic in any respect"; but, by section 27 of the 1888 Act, the Railway Commission or Court having jurisdiction in the matter, in deciding whether a lower charge or difference does or does not amount to an undue preference, "may, so far as they think reasonable, in addition to any other considerations affecting the case, take into consideration whether such lower charge or difference in treatment is necessary for securing, in the interests of the public, the traffic in respect of which it is made, and

whether the inequality cannot be removed without unduly reducing the rates charged to the complainant." The Act thus recognises that preferential rates may be beneficial to the public, or at the worst be unavoidable evils, but it draws the line at undue preference.

When, however, it comes to the definition of that term, its thoughts lie too deep for words, and it emulates the performance of the examinee who defined an archdeacon as one who exercises archidiaconal functions. "Undue preference," the curious may find in section 55, "includes an undue preference or an undue or unreasonable prejudice or disadvantage, in any respect, in favour of or against any person or particular class of persons, or any particular description of traffic." After this luminous exposition, the reader may perhaps feel himself on surer ground when he discovers from section 27 that, whatever undue preference may be, there is a presumption that it is being practised whenever a railway is shown to be charging "one trader or class of traders, or the traders in any district, lower tolls, rates, or charges for the same or similar services" than it charges to other traders or classes of traders, or to the traders in another district, and that the burden of proving that such lower charge does not constitute an undue preference lies on the railway, not the contrary, on the traders. In the case of differential rates between home and foreign merchandise, the Act at first sight appears particularly strict, for it provides that no railway company shall make, nor shall the Court or Commissioners sanction, any difference in the

charges made for, or any difference in the treatment of, home and foreign merchandise, in respect of the same or similar services; but in 1895 it was judicially held that the effect of this proviso is not to prohibit all inequalities in rates as between home and foreign goods, and that a railway proving facts that would justify admitted differences in the case of home goods is not debarred from relying on those facts as an answer, merely because the goods receiving the benefit of the difference are of foreign origin (*Mansion House Association* v. *London and South-Western Railway*, 1895).

It may be asked, Why should the railways adopt a system of preferential rates which is a source of trouble to themselves and a rock of offence to the trading community? The reason, certainly, is not that they are actuated by a malignant desire to benefit the foreigner at the expense of the home trader. A railway, at least in the United Kingdom and the United States, where State ownership is unknown, is a commercial concern, the aim of which is to make profits. Whence those profits come it does not care —a sovereign out of an Englishman's pocket is as good as one out of a Frenchman's or a German's, and there is no reason why it should prefer one to the other. Its object is to get business; the nationality of the persons who supply it with business is a matter as completely unimportant to it as their religion or the colour of their hair. Doubtless, the railways have not always acted wisely in their efforts to foster their business, and it may be conceded that some of their actions have not always been, in fact, calculated to

benefit British traders as compared with foreigners; but to suppose that the motive of those actions has been a desire to damage British trade, is a childish notion that says little for the business capacity of those who entertain it.

The same reasons that compel tradesmen engaged in the same business to charge different prices at different times and places for the same commodity, also compel railways to charge differential and preferential rates, the latter being little else than differential rates looked at from the personal standpoint of someone who thinks he is being wronged by them. No one would expect to buy meat from a butcher in St. James's for the same price as he would pay in Whitechapel, the reason lying, not in the abounding philanthropy of the Whitechapel butcher, but simply in the fact that, his customers being unable to afford St. James's prices, he must either be cheap, or do no business. Similarly with railways. They would, doubtless, be happy to charge equally high rates for all the traffic they carry if it were practicable; but although in some cases, like the St. James's butcher, they can keep up their prices, they know that for many classes of goods their customers could not afford to pay high rates, and, rather than lose the traffic altogether, they content themselves with such lower rates as they can get.

It will not do, however, for the St. James's butcher to presume too far on the richness of his customers, lest they make the discovery that they do not require so much meat as they once supposed. Hence he will not raise his prices unduly, especially as he will

remember that excessive prosperity on his part may tempt a rival upon the scene. Precisely the same thing happens with railways: if they charge excessive rates, they will infallibly retard the development of their traffic and invite the intrusion of competitive lines.

The butcher, again, may perceive that, although he is doing a comfortable business with his high prices, a reduction in them would so increase the number of his customers, and consequently his turnover, that with a smaller profit per pound he could make a much larger income, but he would have to be careful that the increased takings were not all swallowed up in the heavier cost of running a larger establishment. A railway company may reason in the same way. It may see that on one of its lines, A, a reduction of rates will increase the gross receipts without a proportionate increase in expenses of operation, and accordingly it makes the reduction. On another line, B, not considering that the traffic is expansive enough to give any advantage from reduced rates, it maintains the old tariff, and at once there is a pretty case for its enemies, who will scarcely fail to discern in this simple business arrangement a fell plot against the interests of the people who live on line B.

Another reason which would induce the butcher to alter his ways of business would be the appearance of a rival on the opposite side of the street, with a price-list based on a lower scale. The original butcher would then be under the painful necessity of reducing his prices to match, and probably both would find that what was a small fortune for one had become

a poor living for two. Railway companies are exposed to precisely the same vicissitudes of competition, with the same influence on charges, though the circumstances are much more complex. One company has a route from A to B, 100 miles long: if another company is allowed to build another line between those places, which is, say, only 80 miles long, the former company will only be able to charge as for 80 miles for its 100 miles. Moreover, if there should happen to be a place C on its line, 90 miles from A, that too is liable to be charged as if it were only 80 miles, section 27 of the Railway and Canal Traffic Act, 1888, providing that "the Court or the Commissioners shall have power to direct that no higher charge shall be made to any person for services in respect of merchandise carried over a less distance than is made to any other person for similar services in respect of the like description and quantity of merchandise carried over a greater distance on the same line of railway." But here there is at once established, not by the fault or the desire of the railway, a preferential rate against C, which may complain that its trade rivals at B are placed on an equality with it for competition in the common market A, whereas Providence, when it put C at a less distance from A than B, clearly intended it to enjoy natural advantages which are thus nullified.

But what can the offending railway do? It might cease to carry traffic from B to A, or it might reduce the rates from C to A, so as to preserve the natural advantages of C's position relatively to A. But the

first alternative would not help C in the least, since traffic would still travel by the shorter route from B to A; indeed it would probably damage both C and B, the former getting a worse train service, and the latter losing the benefit of competitive routes. The second alternative might please C, but it would mean the establishment of a second series of preferential rates, which would give dissatisfaction to other places.

The competition of other lines is far from being the only competition that British railways have to face. Great Britain being a small island in which no place is far distant from the sea, transport by water is a factor that makes itself felt in a very large proportion of the traffic. If B is a port having water communication with A, the railways connecting A and B will certainly have to take account of that fact in fixing their rates. If they attempt to ignore it, they will force traffic to go by sea; if they try to meet the competition of water-carriage by charging less than the normal mileage rates between A and B, preferential rates at once appear, since goods will be conveyed through from B to A at lower rates per ton per mile than the normal rates charged between intermediate stations. Again, to enable B to compete, in regard to over-sea traffic, with another port which serves the same market, through rates for imported goods may also be fixed on a lower scale. These lower rates may be justified, in part or in whole, by the fact that the railway receives such goods regularly, in big lots, and well packed for handling, whereas home produce is sent spasmodically, in little lots, and inconveniently

packed. But the traders and farmers along the line care for none of these things, and see nothing but the iniquity of railway management. Perhaps in their wrath they apply to the Railway Commission for relief from what they regard as unfair dealing. Yet success before that tribunal would do them no good, and prohibition of the low rates for through traffic would only mean that the railways and the port would lose the traffic in question, while the local rates would stand unaltered.

But, after all, what grounds are there for speaking of unfairness in the matter? A common line of argument is that if railways can "afford" to carry through traffic at low rates, they can "afford" to do the same for local traffic of the same kind. As a matter of fact, this in very many cases is not true; but, even if it were, why should they be asked to take less than Parliament has sanctioned as fair remuneration for the services rendered? The St. James's butcher is not accused of unfair dealing because at the end of the week he sells his remaining stock of meat to poor people at prices much less than he gets from his aristocratic customers; and no one suggests that, because he can afford to sell some meat at low prices to some people, he ought to be forced to sell all his meat at the same low prices to all his customers alike. Why should different rules be applied to the conduct of railways, who are only tradesmen like the butcher, though engaged in a different business? In the second place, there is something to be said from the standpoint of public interest. A general reduction of rates to the level of the lowest would entirely cripple

the railways, and render them unable to give that adequate and satisfactory service which is essential for the commercial prosperity of the country. It is within the experience of everybody that the service supplied by a poor and unsuccessful line is usually far worse than that given by a rich and prosperous one; and with railways, as with other businesses, starvation is not the way to secure efficiency.

A consideration of preferential rates of every kind shows that all (except those granted as personal favours, with which happily this country has not been troubled) are due to the application of one principle—that of charging what the traffic will bear. A railway charges less on cheap than it does on valuable goods, because the former cannot bear more, and would not be sent for carriage at all if high rates were put upon them. It reduces its rates, apart from competition, if it has reason to believe that they are higher than the goods can bear, and that a reduction will lead to an expansion of the volume of traffic without a proportionate increase in the cost of handling it. If it has the longer of two competitive routes, it reduces its rates to the level of those charged on the shorter route, because its traffic will not bear higher charges; and if it has to meet the competition of sea-carriage it modifies its charges accordingly, because its traffic with a cheaper, though less speedy and less sure, means of transportation available will not bear the normal rates, and will be in great part lost by any attempt to impose them.

The principle of charging what the traffic will bear

does not intrinsically mean, as is sometimes supposed, that a railway is to squeeze its traffic for the uttermost farthing that can be extracted from it. Like everybody else, a railway wants to get as much as possible for what it does. One way, the obvious but short-sighted and ineffectual way of doing this, is to charge the highest possible rates and be content with the limited amount of business that can struggle to exist in such conditions: that is the principle of charging what the traffic will not bear. The other way recognises that a small profit, many times repeated, is better than a large one obtained only occasionally, and that a large business affords greater opportunities of gain than a small and restricted one. Hence it means that a railway accommodates its charges to the circumstances of the traffic, and encourages new customers and new traffic by moderate rates and liberal treatment. That is the ideal pointed to by the principle of charging what the traffic will bear. That it still remains in some cases no more than an ideal, that railways still occasionally show themselves grasping, arbitrary, and devoid of sweet reasonableness, is no argument against the principle as the basis of railway charges, but merely an evidence of shortcoming in those who fail to apply it properly.

CHAPTER X

RATES LEGISLATION OF 1891 AND 1892

The Provisional Orders—Classification adopted—Station and Service Terminals—Scales of Rates for General Merchandise and Minerals—Scale for Live Stock—Scales for Perishable Articles and Small Parcels.

THE maximum charges nominally permitted to railways in the United Kingdom for goods traffic—which, it is scarcely now necessary to add, are not identical with those actually made—are laid down in a series of thirty-five Rates and Charges Order Confirmation Acts passed by Parliament in the Sessions of 1891 and 1892. The first nine of these, referring to the Great Eastern, the Great Northern, the London and South-Western, the London, Brighton, and South Coast, the London, Chatham, and Dover, the Midland, the South-Eastern, the London and North-Western, and the Great Western Railways, were passed in 1891, when they cost the Joint Committee of the Lords and Commons who considered them no less than forty-eight sittings. The remainder of the Acts, which included all the remaining railways of the country, were disposed of in 1892 with nineteen sittings.

The principles upon which these Acts should be

drawn were determined by the Railway and Canal Traffic Act of 1888, which provided for, roughly, three things—(1) the codification of the existing powers of railways, then scattered through hundreds of Acts; (2) the revision of existing maximum charges; (3) the fixing of certain charges (in particular, terminals) which so far had not been fixed and defined. To secure these ends, it ordered that within a definite time the railway companies were to submit a revised classification of merchandise traffic, with a schedule of the maximum rates and charges applicable thereto, and to state fully the nature and amounts of all terminal charges which they proposed in respect of each class of traffic, together with the circumstances in which they were to be made. These schedules were to be published, and the Board of Trade was then to hear any objections lodged by traders and others, and to try to reach an agreement with the companies respecting them; failing agreement, it was to determine the classification and schedules itself, and, after a Parliamentary recess, to embody them in a Provisional Order for each company and procure the introduction of Bills in either House for their confirmation.

The schedules were lodged in February 1889, and consideration of the objections duly undertaken, an inquiry instituted for the purpose in Westminster Town Hall holding eighty-five sittings (eight of which were in Edinburgh and four in Dublin) and examining 211 witnesses, of whom 178 were traders. Failing, however, to come to any agreement with the companies, the Board proceeded to draw up a draft classification and schedule of its own. This was submitted to the

companies in August 1890, but did not commend itself to them; hence the Board occupied the winter in further negotiation and discussion, and in drawing up the Provisional Orders which were brought before Parliament as private Bills in the ensuing year. Whatever, therefore, may be the defects in the enactments which became law in 1891 and 1892, and whatever the disappointments suffered by traders in their operation, it can scarcely be said that discussion of the matter was unduly limited, or that ample opportunity was not given to both sides, whether railways or traders, to make their position clear.

The classification adopted was pretty much the same as the Clearing House classification which the railways of the country had already drawn up for their own use, and divided all the various articles which are sent by rail into six categories—(1) Goods and minerals, (2) animals, (3) carriages, (4) exceptional articles, (5) perishable articles carried by passenger trains, and (6) small parcels carried by merchandise trains. Within several of these six main divisions, which are common to all the Acts, and are therefore now in force all over the United Kingdom, there are various further classifications, which are, with slight exceptions, also alike for every railway. Thus the fifth, perishable merchandise, is in three divisions. The first contains milk only; in the second there are such things as butter, cream, eggs, certain kinds of fish, hothouse fruit, game, dead poultry, etc.; while the third comprises ice, together with such kinds of fish and fruit as do not fall in the second division. In the animal class, again, there is

a sub-classification which is not quite the same for Scotland as it is for England or for Ireland, and distinctions are drawn between beasts of burden, cattle, and smaller animals, such as pigs or sheep. But by far the most elaborate classification occurs in the most important section of all—that of general goods and minerals. Here there are eight different classes, called respectively A, B, C, 1, 2, 3, 4, 5, which show a progressive graduation from heavy cheap articles, that are consigned in large quantities, up to lighter and more valuable things which take up more room and require more care and handling. Coal and iron ore, for example, are in class A; slates, pig-iron, manganese ore, in class B; grain and the rougher kinds of manufactured iron and steel, as girders and rails, in class C. At the other end of the scale, class 3 contains such things as books, boots and shoes in cases or boxes, packages of heavy drapery and of hardware articles not gold, silver, or plated; class 4, books bound in calf, boots and shoes in hampers, packages of light drapery, plated goods, and manufactured tobacco (not cigars or cigarettes); and class 5, cigars and cigarettes, cut flowers, stained glass, photographic apparatus, straw hats, etc.

It may be noted that the railways may not transfer an article from a lower to a higher class (in other words, raise the rates for it), except after giving fourteen days' public notice of their intention so to do. Further, they are bound to allow anyone within reasonable hours to inspect the rate-books at their stations, and must keep copies of the classification under which they work, on sale at their principal office at a price not

exceeding one shilling. The Railway and Canal Traffic Act of 1894 imposed still more rigorous restrictions on the raising of rates. It enacted that if a railway company, directly or indirectly, increases any rate or charge above the amount at which it stood at the end of 1892, then, on a complaint being made that the increase is unreasonable, it lies with the company to prove the contrary. For this purpose it is not enough to show that the increased charge or rate is within the limits fixed by Act of Parliament or Provisional Order; the new charge must be justified by some reason, such as increased cost of handling the traffic. This Act was passed in consequence of the outcry raised against the companies because in a number of cases they actually charged the maxima allowed them by the legislation of 1891 and 1892.

The maximum charges that may be made in respect of goods traffic of all kinds are set out under two heads—(1) Station and service terminals, and (2) rates for conveyance. A station terminal is the charge made to a "trader for the use of the accommodation (exclusive of coal-drops) provided, and for the duties undertaken by the [railway] company for which no other provision is made, at the terminal station for or in dealing with merchandise, as carriers thereof, before or after conveyance." Service terminals are charges for the services of loading, unloading, covering and uncovering merchandise, rendered by the company to or for a trader; these charges being deemed, in respect of each service, to include all charges for the provision by the company of labour, machinery, plant, stores, and sheets. The Act of 1888, it may be

mentioned, provided that, in the determination of terminal charges, regard was to be had only to the expenditure reasonably necessary to provide the accommodation, irrespective of the outlay actually incurred. Further, the obligation was imposed on the companies of disclosing how much of their total charge was for conveyance, and how much (if anything) for service terminals or dock charges, within one week after application in writing made to their secretaries by any person interested in the carriage of any merchandise over their lines.

As regards goods and minerals, the following scale of terminal charges is applicable to every railway in the United Kingdom, with the single exception of the Caledonian and North British Railways in respect of merchandise conveyed between Glasgow and Edinburgh, Leith, or Granton, in which cases the station terminals at each end are 1s. a ton for classes C, 1, 2, 3, and 4, and 1s. 6d. for class 5 :—

In respect of Merchandise comprised in the under-mentioned Classes.	Maximum Terminals.				
	Station Terminal at each end.	Service Terminals.			
		Loading.	Unloading.	Covering.	Uncovering.
	Per ton. s. d.	Per ton. s. d.	Per ton. s. d.	Per ton. d.	Per ton. d.
A	0 3	...	...	...	...
B	0 6	...	...	...	...
C	1 0	0 3	0 3	1	1
1	1 6	0 5	0 5	1·50	1·50
2	1 6	0 8	0 8	2	2
3	1 6	1 0	1 0	2	2
4	1 6	1 4	1 4	3	3
5	1 6	1 8	1 8	4	4

The terminal charges authorised in the animal class will be found further on, quoted along with the conveyance rates. In the class of carriages the station terminal allowed at each end is everywhere 1s., with service terminals of 6d. for loading and 6d. for unloading, but nothing for covering and uncovering. For perishable merchandise by passenger train the following maxima are authorised:—

	Station Terminal at each end.	Service Terminals.	
		Loading.	Unloading.
	Per can.	Per can.	Per can.
Division I. (milk) . . .	1·50d.	1·00d.	1·00d.
Returned empty cans . .	...	0·50	0·50
	Per cwt.	Per cwt.	Per cwt.
Division II.	0·75d.	0·75d.	0·75d.
Division III.	0·75	0·50	0·50

When we come to the rates for conveyance, the matter becomes much more complicated. Recognising not only that the circumstances of, say, the railways south of the Thames differ from those of the trunk lines to the north, but also that sometimes portions of the same company's lines differ so much from the rest as to deserve differential treatment, Parliament has sanctioned a variety of scales and numbers of exceptional rates. To give an account of all of these would be impossible in the space at disposal, and no more can be done than to quote a few specimens which will afford a general idea of the charges. The

rates are in every case given in pence per ton per mile.

Goods and Minerals.—The normal scale of the London and North-Western for goods and minerals is as follows:—

In respect of Merchandise comprised in the under-mentioned Classes.	Maximum Rates for Conveyance.			
	For the first 20 Miles or any part thereof.	For the next 30 Miles or any part thereof.	For the next 50 Miles or any part thereof.	For the remainder of the distance.
	Per ton per mile.	Per ton per mile.	Per ton per mile.	Per ton per mile.
A	0·95d.	0·85d.	0·50d.	0·40d.
B	1·25	1·0	0·80	0·50
C	1·80	1·50	1·20	0·70
1	2·20	1·85	1·40	1·00
2	2·65	2·30	1·80	1·50
3	3·10	2·65	2·00	1·80
4	3·60	3·15	2·50	2·20
5	4·30	3·70	3·25	2·50

But from this scale there are important exceptions, so far as class A is concerned: thus on many of their Welsh lines, including in particular the Chester and Holyhead, the company may charge 1·25d. per ton per mile, while on some hilly sections, such as the Cromford and High Peak and the Lancaster and Carlisle, the maximum rate rises to 2d.

The North-Western normal scale applies with little or no alteration to such lines as the Great Northern, the Great Western, and Midland, though the last-named is allowed for goods in class A 1·15d. per ton per mile for the first 20 miles, 0·90d. for the next 30 miles, and 0·45d. for the next 50 miles. On the

North-Eastern the rates are the same as far as classes 1, 2, 3, 4, 5 are concerned, but for classes A, B, and C the following are the charges, except for coal for shipment, for which other schedules are substituted:—

In respect of Merchandise comprised in the under-mentioned Classes.	Maximum Rates for Conveyance.			
	For the first 10 Miles or any part thereof.	For the next 10 Miles or any part thereof.	For the next 15 Miles or any part thereof.	For the remainder of the distance.
	Per ton per mile.	Per ton per mile.	Per ton per mile.	Per ton per mile.
A	1·75d.	1·25d.	0·75d.	0·60d.
B	1·90	1·25	1·00	0·75
C	2·00	1·75	1·50	1·25

One of the reasons for this difference in charge, as compared with the North-Western or the Great Northern, is to be found in the fact that, whereas the provision of trucks is usually not included in the maximum rates applicable to class A, on the North-Eastern the contrary is the case, so that the extra mileage rate is really of the nature of payment for use of vehicles. Other lines are authorised to charge for the use of trucks they may provide, if they are not already included in the rates, 4½d. per ton for distances not exceeding 20 miles, 6d. per ton for distances between 20 and 50 miles, 9d. per ton for distances between 50 and 75 miles, 1s. per ton for distances between 75 and 150 miles, and 1s. 3d. per ton for greater distances. The Midland and North Staffordshire may charge 6d. per ton for any distance

less than 50 miles. The general scale authorised for the southern railways, London and South-Western, London, Brighton, and South Coast, South-Eastern, etc., is as given below; but all of them are allowed an additional 0·4d. per ton per mile as regards classes A, B, and C for various sections of line near London, and the London and South-Western also gets 3d. a mile instead of 2·90d. for goods in class 5, "for the remainder of the distance":—

In respect of Merchandise comprised in the under-mentioned Classes.	Maximum Rates for Conveyance.			
	For the first 20 Miles or any part thereof.	For the next 30 Miles or any part thereof.	For the next 50 Miles or any part thereof.	For the remainder of the distance.
	Per ton per mile.	Per ton per mile.	Per ton per mile.	Per ton per mile.
A	1·50d.	0·95d.	0·75d.	0·60d.
B	1·60	1·10	0·85	0·70
C	1·80	1·50	1·20	0·70
1	2·25	1·90	1·65	1·35
2	2·75	2·35	2·05	1·65
3	3·10	2·80	2·50	2·10
4	3·75	3·35	3·15	2·50
5	4·30	3·90	3·80	2·90

On the Scotch railways the maximum rates also include the provision of trucks in every case, and the rates allowed for classes A, B, C are based on the same mileage division as the North-Eastern's, and are mostly about the same in amount, though rather higher per ton for B and C for the first ten miles. For classes 1 to 5, the schedules, if slightly higher in some items, are substantially identical with the North-Western's. The Great North of Scotland is somewhat peculiar

in that its rates for classes A and B are alike throughout.

The rates sanctioned for the Irish railways are shown in the following table:—

In respect of Merchandise comprised in the under-mentioned Classes.	Maximum Rates for Conveyance.			
	For the first 20 Miles or any part thereof.	For the next 30 Miles or any part thereof.	For the next 50 Miles or any part thereof.	For the remainder of the distance.
	Per ton per mile.	Per ton per mile.	Per ton per mile.	Per ton per mile.
A	1·40d.	0·90d.	0·70d.	0·50d.
B	1·50	1·15	0·80	0·55
C	1·95	1·50	1·20	0·70
1	2·40	2·05	1·85	1·45
2	2·70	2·30	2·00	1·55
3	3·10	2·75	2·45	2·05
4	3·65	3·30	3·05	2·40
5	4·30	3·90	3·80	3·00

Before leaving the rates for goods and minerals, it may be mentioned that those of A and B are only applicable to consignments of 4 tons and upwards, and those of C to consignments of 2 tons and upwards. For a consignment of merchandise in class A amounting to less than 4 tons but more than 2 tons the railway may charge the rates applicable to class B, or if it is less than 2 tons those applicable to class C. Similarly, goods in class B, if in consignments weighing between 4 and 2 tons, are liable to be charged as if they fell in class C, or, if less than 2 tons, in class 1. Merchandise in class C, consigned in quantities less than 2 tons, may be charged the conveyance rates of class 1. But in none of these cases may a railway

charge more than as for a consignment of 4 tons or of 2 tons respectively.

Various exceptional charges are also authorised in the case of very short hauls, and to recoup the owning company for the expense of particularly costly works. In general, when goods are conveyed for less than 3 miles, the railway may charge for 3 miles; if a station terminal is chargeable at one end only, it may charge any part of 4½ miles as 4½ miles; and if no station terminal is chargeable at either end, it may charge any part of 6 miles as 6 miles. The provision, however, is inserted that where merchandise is conveyed by the company partly on its railway and partly on the railway of any other company, its railway and the railway of such other company shall for the purpose of reckoning such short distance be considered as one railway. As examples of exceptional charges allowed in respect of specially expensive works, the following may be quoted:—In London, the Chatham and Dover's line, from Victoria Station to Wandsworth Road, in calculating the distance over which any merchandise is conveyed, and for all purposes of rates and charges, may be counted as 12 miles, though the distance is really about 2; while in the provinces Runcorn Bridge may be counted as 9 miles, the Severn Tunnel as 12 miles, and the high-level bridge at Newcastle-on-Tyne as 3¼ miles.

Animals.—For the conveyance of animals, the scale on the next page applies to all English railways, and also, with modifications, to the Scotch and Irish lines. For Scotland, paragraphs 5 and 7 are omitted. In Ireland the trucks are of different sizes, and, while

Description.	Rate for Conveyance per Mile.				Station Terminal at each end.	Service Terminals.		Minimum Total Charge per Consignment.
	For the first 20 Miles or any part thereof.	For the next 30 Miles or any part thereof.	For the next 50 Miles or any part thereof.	For the remainder of the distance.		Loading.	Unloading.	
	d.	d.	d.	d.	s. d.	s. d.	s. d.	s. d.
1. For every horse, mule, or other beast of draught or burden . . .	3	3	1·65	1·65	0 6	0 4	0 4	2 6
2. For every ox, cow, bull, or head of neat cattle	2	2	1·30	1·30	0 4	0 3	0 3	2 6
3. For every calf not exceeding twelve months old, pig, sheep, lamb, or other small animal . . .	0·75	0·75	0·40	0·35	0 2	0 1·50	0 1·50	2 6
4. For every animal of the classes above enumerated conveyed in a separate carriage, by direction of the consignor or from necessity. . .	6	6	6	6	1 6	1 0	1 0	5 0
5. For each truck containing any consignment by the same person of such number of oxen, cows, neat cattle, calves, sheep, goats, or pigs, as may reasonably be carried in a truck of 13 ft. 6 in. in length inside measurement	6	5	4·90	4·20	1 0	0 6	0 6	5 0
6. Ditto in truck 15 ft. 6 in. in length inside measurement . . .	7	6	5·20	4·50	1 0	0 9	0 9	5 0
7. Ditto in truck 18 ft. in length inside measurement.	8	7	6·20	5·50	1 0	1 0	1 0	5 0

the conveyance rates for them correspond to paragraphs 6 and 7, the service terminals are those allowed in paragraphs 5 and 6.

Carriages not weighing more than a ton are charged 6d. a mile for the first 50 miles, 3·30d. for the second 50, and 3·20d. for any greater distance; if they weigh more than a ton, an additional charge is authorised for each quarter-ton. An extra charge of 10s. may be made for the use of a covered truck.

Perishables.—For the three divisions into which perishable merchandise by passenger train is classified (see p. 199), the following are the rates for conveyance. The minimum consignment of milk is 12 gallons, the railway being entitled to charge for smaller consignments as if they amounted to that quantity. Consignments of articles in divisions II. or III., weighing less than one hundredweight, may be charged as one hundredweight, the minimum charge being one shilling:—

DIVISION I.

For any distance not exceeding 20 Miles.	For any distance exceeding 20 but not exceeding 50 Miles.	For any distance exceeding 50 but not exceeding 75 Miles.	For any distance exceeding 75 but not exceeding 100 Miles.	For any distance exceeding 100 but not exceeding 150 Miles.	For any distance exceeding 150 Miles.
Per imperial gallon.	Per imperial gallon.	Per imperial gallon.	Per imperial gallon.	Per imperial gallon.	Per imperial gallon.
0·50d.	0·60d.	0·70d.	0·90d.	1·00d.	1·20d.
RETURNED EMPTY CANS.					
Per can.	Per can.	Per can.	Per can.	Per can.	Per can.
1·50d.	2·00d.	2·25d.	2·50d.	3·00d.	3·00d.

DIVISIONS II. AND III.

	For the first 20 Miles or any part thereof.	For the next 30 Miles or any part thereof.	For the next 50 Miles or any part thereof.	For the remainder of the distance.
	Per cwt. per mile.	Per cwt. per mile.	Per cwt. per mile.	Per cwt. per mile.
Division II. .	0·60d.	0·45d.	0·24d.	0·10d.
Division III. .	0·40	0·30	0·13	0·12

"*Smalls.*"—On every small parcel, weighing less than three hundredweight, sent by merchandise train, beyond the maximum rates for conveyance and station and service terminals, an additional charge is authorised, varying from 5d. up to 1s. 6d., according to the amount of the maximum "tonnage charge," *i.e.*, sum of the terminals and conveyance rate combined.

Exceptional Class.—Finally, in the exceptional class, which includes unusually long, heavy, or bulky articles, specie, bullion, or precious stones, wild beasts, dangerous goods, services the remuneration for which is not otherwise determined, etc., the railways are authorised to charge such reasonable sums as they may think fit in each case.

CHAPTER XI

CAPITAL, EXPENSES, AND DIVIDENDS

High Capitalisation of British Railways—Its Explanation—Cost of Construction—Causes of Growth of Capital—Betterments and Capital Account—Productiveness of Capital Expended—Increased Expenses and Decreased Dividends—Prospects of Future Improvement—Employment of Electrical Traction.

THE railways of the United Kingdom had in 1901 a total paid-up capital of about 1195 millions sterling. Of this sum by far the largest part was on account of the railways of England and Wales, which were responsible for over 83 per cent., Scotland's share being 14 per cent., and Ireland's only 3. This amount may be distinguished into three groups. Loans and debentures, which amount to about 26 per cent. of the total, form a first charge on the net revenue of the undertakings, that is, their holders have the first claim, up to the amount of the interest due to them, upon any surplus that may remain after the costs of working have been met; if the interest is not paid, they may put in a receiver, but cannot seize the rolling stock or other effects. In the second group come guaranteed and preference stocks, which make up 36 per cent. of the total capital. Holders of these are entitled to a fixed rate of interest, varying

according to the terms of the arrangement in each case, but in practice limited to 6 per cent., in preference to the ordinary stocks, after the claims of the debenture holders have been satisfied. The holders of ordinary stock, which constitutes about 38 per cent. of the total, take what remains of the sum available for dividend, after the guaranteed and preference shareholders have received their money. Loans and debentures are limited by a Standing Order of the House of Commons to 25 per cent. of the total capital obligations; but in fact in England they form over 27 per cent., and in Ireland over 30 per cent., though in Scotland they fall to 20 per cent., the ordinary capital in that country accounting for 45 per cent. of the whole.

When this huge capitalisation is examined with reference to the length of line in existence, it is found that, for every mile of railway in the United Kingdom, the paid-up capital amounts to £54,152. If England and Wales be taken alone, the sum is still greater—£64,453; but in Scotland it falls to £47,350, and in Ireland to £15,665. These figures exceed those for every other country in the world, and when they are put side by side with those of the United States—the only country except the United Kingdom in which the railways are private not State enterprises,[1] and with which, therefore, comparison can be made on equal terms—it will be seen that even the lowest of them is distinctly high. The average capital per mile in the United States is less than £13,000, and for the

[1] In a few unimportant cases the Treasury has made grants in aid of the construction of new lines in the United Kingdom.

lines in Kentucky, Alabama, Florida, etc., comprised in group V. of the Inter-State Commerce Commission's classification, it falls to not much over £8000; even in the States of New York and Pennsylvania, where population is densest and land most expensive, the average does not rise to £23,000.

It must be remembered, however, that in America, of the total length of line, over 90 per cent. is single, whereas in Great Britain and Ireland over half of the total consists of two or more lines. A fairer comparison between the capitalisation of the railways in the two countries is therefore to be obtained by taking the single-track mileage, not the geographical length of line, as the basis of calculation. If that is done, the average for a mile of single track is seen to be about £11,100 in America, and in the United Kingdom about £33,100, or, if nominal additions to capital be deducted, about £28,000. For the railways of England and Wales, Scotland, and Ireland, separately, the capital per mile of single line is about £36,320, £33,525, and £10,490 respectively, or, if nominal additions be deducted, £31,065, £24,702, and £10,404.

Part of the explanation of the difference between the capitalisation of American and British railways is to be sought in the greater cost of construction of the latter, due partly to the different attitude adopted towards railways in the two countries. In America, generally speaking, they have been welcomed as a benefit to the community, and facilities have been offered for their construction. They have not, for instance, been obliged in their initial stage to pay for

so costly and complicated an inquiry as Parliament imposes on railway schemes in this country, and often the land on which their track is laid has been granted to them without payment. In England, on the other hand, it might almost be said that they have been looked upon as a kind of public nuisance, which ought to be obliged to pay heavily for the mere privilege of existing; and their promoters have, as a rule, had to work in the face of obstruction from all sorts of quarters, especially from the landed interests. Many instances can be found in which a landowner has objected violently to a railway planned to run through his estate, has put its promoters to as much expense as possible in meeting opposition before the Parliamentary Committees which have considered the Bill, and, on the pretext of damage to the amenities of his estate, has extracted from them a very high price for the land required, all the time knowing well that the line would immensely increase the value of the rest of his property, and bring him a handsome unearned increment. The fees paid to lawyers and witnesses during the promotion of Railway Bills have amounted to hundreds and even thousands of pounds for each mile of line authorised, and sometimes have been run up to still more inordinate sums, as in the case of the London and Blackwall Railway, for which they are said to have exceeded £14,000 a mile. As to the prices squeezed out of railway companies for land, one or two instances from the Great Eastern system must suffice. The first Eastern Counties line, from which it has grown, is believed to have paid about £12,000 a mile for purely agricultural land,

and quite recently the Great Eastern itself had to pay £100 an acre for land which, before the construction of its line, would not have fetched £10 per acre. The land required for the latest addition to its system, the Woodford and Ilford line, cost £518 per acre on the average, or over £12,000 per mile of line—not much less than the average total capital per mile of American railways in 1901.

Then, in regard to engineering construction, American railways have another advantage. English lines, almost from the beginning, were laid out in a very expensive style, with easy ruling gradients, wide curves, and permanent way of the most solid description. In America, on the contrary, much of the construction—and quite properly in the circumstances—was of the cheapest and most flimsy character, and, in the absence of expenditure on betterments, remains so to this day in some of the western regions, where one may see the track writhe and twist as the train passes over it. In England, station buildings and approaches become a heavy item, especially if they are in a large town where enormous sums have to be paid for the land they occupy. On the Woodford and Ilford line just mentioned, the cost of half a dozen wayside stations, constructed in accordance with the requirements of the Board of Trade, was £50,000. In America, stations make far less demand on the capital account. In some of the big towns they are fine buildings, affording accommodation equal, if not superior, to anything in this country; but the average wayside station is behind even the worst of our specimens, bad as they often are, and consists simply

of a wooden hut by the side of the line. Platforms, such as we are accustomed to, are unknown; at the best, they are only a few inches high, and even at big stations they are often omitted altogether from many of the roads, passengers alighting on the ballast, and finding their way to the exit as best they can across several running tracks. Bridge-building, again, is an expensive matter for British railways—on the Woodford and Ilford line nearly £10,000 a mile was spent in dealing with public bridges—but is of much less importance in American railroad practice, because, taking the country as a whole, overhead bridges are distinctly rare. Even when one line crosses another it usually does so at grade-level, and it is no uncommon thing to see an express train pursuing its course across and sometimes along the main streets of an important town, separated from the ordinary road traffic merely by a slight gate or railing.

Although cost of construction is among the most important of the factors that have contributed to the disparity of capitalisation, it is to be remembered that amount of paid-up capital does not afford any exact measure of cost in either country. In America, at different times, many of the railroads have issued large amounts of "watered" stock, have come into the hands of receivers, have written down their capital, and perhaps levied assessments. After a series of such operations, the precise relation which the nominal paid-up capital bears to the amount of money actually spent on the line is somewhat difficult to discover. Of late years, again, some American railways have been spending large sums out of revenue

on their permanent way and equipment; the money thus utilised does not appear in the capital accounts at all. In this country, too, although the financial history of the railways has been tame and colourless compared with the excesses committed in America, various factors combine to obscure the relations between capital and cost. On the one hand, the companies have put aside money out of revenue for the improvement of their lines and equipment, and have devoted to the same purpose considerable amounts received as premiums on the issue of new stock over par. On the other hand, many of them have increased the apparent magnitude of their capital by the issue of large blocks of stock at a discount, and by nominal additions due to the consolidation, conversion, and division of stocks. A company having £1,000,000 of 6 per cent. guaranteed stock may see some advantage in replacing it with stock bearing a lower rate of interest, say, 4 per cent.; in that case it converts it into £1,500,000 4 per cent. stock, the result being a nominal increase of £500,000 in its capital, although the amount paid as interest remains unaltered. "Stock-splitting" is an operation of this kind, which has found favour with several British railways. One of the most recent examples was afforded by the Midland Railway, which in 1897 divided every £100 of its ordinary stock into £100 of preferred ordinary and £100 of deferred ordinary, the former receiving a fixed dividend of 2½ per cent., and the latter what remained of the amount available for distribution after payment of the preferred ordinary and all prior

dividends. Nominal additions of this sort to the capital of British and Irish railways have been especially frequent during the last two or three decades, and now amount to about 190 millions, so that their real capital (making, however, no allowance for stock issued at a discount) is about 1000 millions.

So far as British railways owe their high capitalisation, in comparison with the railways of other countries, to unavoidable cost of construction, they are rather to be pitied than blamed. But is that the whole story? Since the early 'seventies the amount has doubled itself, but the length of line open has grown only from 15,376 miles in 1871 to 22,078 miles in 1901. Looking at these figures, there are not wanting people who hold that the increase of capital is not adequately explained by cost of construction and is disproportionate to the increase in mileage, and who assert that the magnitude of the capital at the present time is the result of faulty finance, of persistently charging to capital items which, on the ordinary principles of business administration, ought to be paid out of revenue. The suggestion of financial demoralisation of this kind is not new. So far back as 1885 President Hadley wrote in his book on *Railroad Transportation* (p. 155): "It is impossible to avoid a suspicion, which the secrecy of English railroad accounts prevents us from proving or disproving, that certain leading English railway companies have been in past years paying dividends out of capital, dividing as large a proportion of the gross earnings as possible, swelling the construction account unfairly, and borrowing money for expenses which

should have been paid out of revenue." More recently, in 1902, an "American Railway Official," writing in *The Times*, stated, after an examination of the accounts of the North-Eastern for the second half of 1901, that the company's "current operating charges were relieved at the expense of capital," and hinted plainly enough that a similar profligate policy has been common among the railways of the United Kingdom.

In discussing the question whether or not the increase in mileage has been at all proportionate to the growth of paid-up capital, a fact not infrequently ignored by railway critics must be taken into account, namely, that every railway does not consist of the same number of tracks. The results cannot fail to be misleading, if comparisons of capital and expenditure are made on the basis of geographical mileage. As an example, take the Great Eastern. According to the Board of Trade Returns, the length of line that company had open was 1104 miles in 1891, and 1109 miles in 1901. A hasty inquirer might conclude that its system had remained practically unaltered in the ten years, especially when he found these figures being used by the Board in its comparative analysis of costs of maintenance from year to year. But in fact, as may be seen by expressing the miles of double, triple, and quadruple lines in terms of single-track mileage, the length of line which the company has to keep in repair increased by nearly 200 miles in the decade, because, while it diminished its single-line railways by 49 miles, it increased those with two lines by 39 miles, those with three lines by 8 miles, and those with four or more lines by 14

miles. This widening process is one to which all the big lines running out of London (except the newly arrived Great Central) have been forced during the last twenty years or so by the continual growth of their traffic, and it has contributed materially to the expansion of their capital accounts.

If geographical mileage alone be considered, then the paid-up capital of British railways apparently increased per mile from about £36,000 in 1871 and £41,000 in 1881 to £45,500 in 1891 and £54,000 in 1901. These figures certainly invite the inference that capital expenditure has been extravagant and quite disproportionate to the amount of constructive work the railways have to show for it. But if the mile of single track is taken as the unit for comparison, in place of the indefinite and misleading geographical mile of line open, the increases are distinctly reduced and the amount of capital per mile becomes £28,500 for 1891 and about £33,100 for 1901. But even these latter figures are fictitious to a certain extent, because of the nominal additions to capital referred to on page 218 above: if deductions be made on account of these, the paid-up capital per mile of single track falls to £26,500 in 1891 and to £28,000 in 1901. That is to say, in the period 1891–1901, when 275 millions sterling were added to the capitalisation of British and Irish railways, what at first sight appears to be the huge increase of £8500 a mile, turns out to be the much more modest sum of about £1500, when judged by a unit which allows account to be taken of a portion of the engineering work put into the railway in the interval.

Although it would not be difficult to mention instances in which the building of a new line, or the addition of a new track to an existing line, has cost quite as much as the average paid-up capital per mile of 1901, the engineering costs of constructing new railways are far from being the only expenses included in the capital figures given above. The growth in the volume of traffic has involved the provision of extensive siding accommodation, including, in American parlance, both yard track and side track; yet, important as is this item, the Board of Trade Returns do not give the slightest clue to either its length or its cost. Increasing density of traffic has further necessitated large additions to rolling stock. The railways of England and Wales in 1901 had 604,759 vehicles of all sorts, against 479,072 in 1891, and, though in some cases the cost of these has been defrayed out of revenue, much of it has gone to swell the capital account. Railways engaged in making improvements in urban areas are exposed to another expense—that of re-housing the population they may displace. The result is that, in addition to paying huge sums for the land they need for their own purposes—the land required by the London and Brighton Company for the enlargement of Victoria Station is costing about £100,000 an acre, including compensation—they have first to hunt out a suitable site for workmen's dwellings, and then to erect upon it costly blocks of buildings, which in most cases are not occupied by the displaced workmen at all, but by an entirely different population.

Again, the immunity from accidents enjoyed by

railway travellers in Great Britain cannot be got for nothing, and considerable expenditure has been thrown on the companies of late years by statutory enactments, designed to ensure safety in working, and to protect the lives both of passengers and of railway servants. The most important of these is the Regulation of Railways Act of 1889, which enforced the use of continuous automatic brakes on all passenger trains, and ordered the adoption of the block system on passenger lines, and the interlocking of points and signals. Seeing that the outlay involved under the provisions of this Act can scarcely be regarded as profit-earning, the money required was far too often treated as addition to capital; but in this policy the companies were directly encouraged by Parliament, which gave them the power to issue debenture stock for the purposes of the Act, on the simple certificate of the Board of Trade. Moreover, they incurred unnecessary expense by the manner in which they carried out the Act. Instead of agreeing upon one standard form of brake which would have been universally applicable, some of them adopted an apparatus actuated by compressed air, others one actuated by vacuum. Since these two forms cannot be worked together, almost every company is under the necessity of fitting both to a certain number of vehicles required for interchange traffic with other companies. This fact has entailed, and still entails, a waste of money which might have been avoided; and further, in some circumstances, it involves a reduction in the available brake-power of a train. For the sake of economy, vehicles are sometimes fitted

with pipes for use with both forms, but with brake blocks only in connection with one. That is to say, supposing they have the complete vacuum apparatus, they are practically unbraked when run in a train which is being worked with the air brake, and the retarding power at the disposal of the driver is *pro tanto* diminished.

A later Act, the Railway Employment (Prevention of Accidents) Act of 1900, gave the Board of Trade power to make rules respecting certain specified subjects, with the aim of reducing or removing the dangers incidental to railway service. It is under this Act that the Board is seeking to impose on the railways the obligation of fitting all goods trucks with brakes which can be applied and released from either side of the wagon indifferently. At present this rule has not been put into operation, owing to the objections and difficulties brought forward by some of the companies, but if it is enforced it will involve them all in considerable expenditure. Automatic couplers are another appliance which might be inflicted upon the railways under this Act, although at present there does not seem to be much chance that this will be done. For some people, of course, the mere fact that they are used in America is a sufficient reason for their adoption here; but to those who can consider them in the light of the different conditions that prevail in this country, their advantages do not seem so certain. So far as they conduce to safety by relieving the shunters of the necessity of going in between the wagons, the same end can be attained equally well by means of some mechanical

coupling and uncoupling appliance for manipulating the present chain couplings. As to the claim that they effect economies in working, any gain would probably be more than neutralised by the cost of fitting them, for it must be remembered that their cost relative to the volume of traffic would necessarily be greater here than in America, owing to the smaller size of our trucks. Nor have the mechanical difficulties connected with them been completely overcome, even in the United States, where central buffers are universal. With the side buffers in use here, the problem is probably still more complicated; yet it would have to be faced, for the idea of evading it by replacing side buffers with central ones on all our railway stock is scarcely practicable, if only because of the dislocation of traffic that would be involved during the process of transition.

Whether the various expenses referred to above should be charged to revenue or to capital, is a question on which there is often room for legitimate difference of opinion. In general, everybody agrees that productive new works may fairly be treated as capital expenditure, while revenue should bear the cost of maintaining the existing line and works in proper repair, as well as the expenses of carrying on the railway. But, after that, disagreement begins. A good deal of the trouble arises from the fact that the railways have not as yet reached a stationary condition; their traffic is continually increasing, and to meet its requirements they find themselves obliged to undertake new works and improvements, which cannot be said to be directly productive of new

revenue, but which yet transcend the limits of maintenance of existing works. In America the straiter sects of railway economists profess the somewhat austere theory (perhaps as an atonement for the past sins of American railroad finance), that such expenses should be charged to revenue. This theory is certainly put into practice in some cases, but it has often been liable to modification according to the exigencies of the stock markets, and the desirability or otherwise of declaring a dividend. Some American companies go even farther along the path of financial virtue, and, not content with paying for all their betterments out of revenue, accumulate large reserve funds, which apparently in some cases they swell by the expedient of distributing no dividends, even though enough is earned to pay 7 or 8 per cent. a year. Such a policy may be magnificent, but it is scarcely business: people invest money, not for the purpose of seeing the profits accumulate, but to get some return upon it. After all, a railway company is not like a mine, the owners of which must expect their property to be worked out and become worthless in a limited number of years. So long as the country it serves remains inhabited, it may fairly suppose that people will travel and goods be sent from place to place; and its present shareholders do as much as can be reasonably asked of them for future generations, if they provide liberally for repairs and renewals, and perhaps in addition build up a moderate reserve fund to meet unexpected contingencies.

In Great Britain both principles and practice have been less heroic than the most advanced American

theory, and undoubtedly there has been a tendency to call upon capital, rather than revenue, to bear the cost of such betterments as replacing old bridges with new and stronger ones, or rebuilding and enlarging passenger stations or goods depôts. But it would not be true to say that this is the universal practice. The Midland, for instance, is not a line which has acquired for itself a reputation for being unusually careful in its capital expenditure; yet, in 1902, when ten new passenger locomotives were built at a cost of £30,000, to replace some that had cost £23,000, the whole of the expenditure was paid for out of revenue, as also was the cost incurred in strengthening certain bridges to bear the weights of these new engines. When stations are rebuilt or enlarged, the custom of the same company is to debit capital only with the difference between the money expended and the cost of the old station, calculated on a liberal basis. On the other hand, it falls in with the usual British practice of treating the cost of widening existing lines as entirely capital expenditure, although such widenings may from some points of view be accounted "betterments" like rebuilding a station or strengthening a bridge, since they mainly facilitate the conduct of the old traffic, rather than of themselves create new business. Yet it is difficult to see how else they could be paid for. If the money distributed as dividends were to be applied for the purpose, considerable hardship would be imposed on the ordinary shareholders, and, what is still more important, there would be a danger of capital being scared away from railway investments. The "closing" of capital

accounts is an attractive dream, which is likely to become a reality only when the trade of this country ceases to grow and starts to go downhill.

But has the capital expenditure of British railways in fact proved so unproductive as is assumed by those who see in over-capitalisation the cause of the period of reduced prosperity through which they have recently been passing? One method of attacking this question is to compare the gross receipts from all sources with the amount of paid-up capital in different years, though of course this test is only valid on the supposition that the receipts have not, in any improper way, been helped at the expense of capital. Comparing 1891 with 1901, we find that the gross receipts in both cases formed almost exactly the same percentage on the capital, namely, 8·90 per cent. in the former year, and 8·91 per cent. in the latter. This calculation is made on the gross paid-up capital, without allowing for nominal additions; if these are deducted, 1901 is seen to be distinctly ahead of 1891, the percentages for the two years working out at 10·57 and 9·57 respectively. It must be noted, however, that there is a slight difference in the way in which the accounts are made up for the two years. In 1901, for the first time, the gross receipts and expenditure on hotels were included by all the companies in the returns they sent in to the Board of Trade, whereas formerly several of them included only the net receipts they obtained under this head. Hence the gross receipts of 1901 are swollen by an item, amounting to about a million sterling, which is omitted from those of earlier years, and the deduction

of which would reduce their percentage relation to the paid-up capital by about 0·1 per cent.

These figures point to the conclusion that the railways were in 1901 able to obtain a bigger return on the money sunk in their business than they were in 1891, and so far negative the idea that their capital expenditure has been reckless and unremunerative. Nor can it be said that 1901 was an exceptionally favourable year for the comparison. On the contrary, it witnessed a distinct slackening in the increase of gross receipts as compared with previous years—indeed the goods receipts were actually less than in the preceding year; and whereas the total gross earnings rose by 3½ millions sterling from 1896 to 1897, by 2½ millions from 1897 to 1898, by over five millions from 1898 to 1899, and by over three millions from 1899 to 1900, the increase from 1900 to 1901 was only 1¾ millions. If 1900 be compared with 1890, the percentage of the gross receipts to the capital remains a little over 8·9 in both cases; but if the nominal additions be deducted, it stands at 9·51 for 1890, and rises to 10·59 for 1900. In 1902 the proportion was all but 9·00, or, the nominal additions being deducted, 10·65 per cent.

Unfortunately for railway shareholders, dividends have not increased proportionately with the increased yield on capital thus indicated; rather they have steadily tended to diminish. Up to and including 1891 the average rate of dividend or interest on every kind of stock—ordinary, preference, and debenture—was never below 4 per cent.; since 1891 it has never reached 4 per cent. Between the

latter year and 1901 the average rate of interest on railway loans and debenture stock fell nearly one-half per cent., and the dividend on guaranteed and preference capital exactly one-half per cent., while the return on the ordinary capital was reduced from 4·24 per cent. to 3·05 per cent. on the average. It must be remembered, however, that some of this decrease is nominal—holders of stock may be receiving a smaller interest or dividend per cent., but they hold a larger amount of stock to receive it upon. For instance, in 1891 there were over 130 millions of debenture stock bearing 4 per cent. interest; in 1901 this sum had been reduced to 82 millions. On the other hand, the amount of 3 per cent. debenture stock in 1891 was 44½ millions; in 1901 it had grown to nearly 134 millions. Some of this increase is, of course, due to new issues, but much of it is the result of conversion. The same sort of thing may be observed in the ordinary capital. If the additions to the ordinary capital of the railways since 1888, on the division of ordinary stock into preferred ordinary and deferred ordinary, had not been made, the dividend on it would have been on the average not 3·05 per cent. but 3·6 per cent. in 1901.

Still, even this enhanced figure is 0·62 per cent. less than the average paid on the ordinary stock ten years previously, and the question arises, What is the cause of the difference? Since the gross receipts have been maintained — indeed improved on — in proportion to the total paid-up capital, and since no abnormal sums have been put aside in reserve funds, the only answer possible is that more has been absorbed in the

costs of working and maintenance, so that less remains to meet the interest charges and provide dividends. At one time the railways, as a whole, were able to work their lines for one-half or less of their gross income. In the halcyon days of 1850, when it received nearly 7s. 6d. per passenger train-mile and twice as much per goods train-mile, the Great Western was able to run its business for an expenditure of 38 per cent. of its income. But from about 1873 things changed. In that year, for the first time, the working expenses for the railways generally were more than half the gross receipts, and since then they have never been less than 51 per cent. Except once, in 1874, they did not reach 55 per cent. till 1891, but since that date they have risen to 58 in 1898, 59 in 1899, and 62 in 1900, culminating in 1901 with 63.

This increase in cost of working is shown clearly enough by comparing the amount spent in different years for each train-mile run. On all the railways of the United Kingdom (steamboat, canal, harbour, and dock expenses being omitted), this figure varied in the ten years 1882–1891 between 29·97d. in 1888 and 32·47d. in 1882; in the succeeding decade the minimum was 32·24d. in 1892, and the maximum 38·76d. in 1901. As already mentioned, however, there was in 1901 a change in the method of presenting certain items of the accounts, which meant an apparent increase of about ¾d. a train-mile. If this alteration is allowed for, the increase in the expenditure in the decade 1892–1901, or rather in the latter half of it—for the rise only began seriously in 1897—may be put at not much less than 6d. a train-

mile. Now the total distributed for interest and dividend on every description of capital in 1901 works out at about two shillings a train-mile. If, therefore, the same gross receipts could have been obtained per train-mile without spending the extra sixpence on working expenses, the amount available for dividend purposes would have been about half-a-crown per train-mile, and the ordinary capital, being entitled to all the extra earnings (after satisfaction of debenture and preference charges now in default), would have received an average dividend of nearly 5 per cent.

Of this extra sixpence per mile more than one-third, or 2·30d., is accounted for by the increased expense of locomotive power, the provision of which cost 9·45d. per train-mile in 1891 and 11·75d. in 1901. The chief cause of this difference was the dearness of coal. In 1901 the railways had to spend twice as much on their fuel as they did in 1896, and between 1891 and 1901 the train-mileage increased 20 per cent., but the cost of coal and coke over 40 per cent. Enhanced cost of materials had doubtless something to do also with the rise of a halfpenny per train-mile in the expenses of maintenance of way and works during the same period. Further, larger sums had to be spent in wages. The cost of the labour employed in the running portion of the Locomotive Department was greater by 43 per cent., and in the repairing portion by 30 per cent. In the Traffic Department there was an increase of 1·73d. per train-mile between 1891 and 1901, which again is largely attributable to increased expenditure in wages. Finally, to omit some smaller increases, rates and

taxes were higher in 1901 than they were in 1891 by 0·73d. per train-mile, or almost 44 per cent., and the sum which the railways had to pay under this head rose from £2,246,000 in 1891 to £3,980,000 in 1901, and £4,227,000 in 1902. Some of the companies find that in ten years their rates have increased by an amount equivalent to 1 per cent., or even more, on their ordinary capital.

It will be noticed that a good many of these items of increased expense are outside the control of the companies. When the extravagance of a municipality with a fancy for running electric tramways at a loss causes an increase in the rates, a railway has to pay its share of the increase—sometimes even more than its share—and though it may, and often does, succeed in getting its assessments lowered, that does not help it in the long-run, for the municipal authority will have the money for its "enterprise" somehow, and all that is gained from a reduction in the assessment is an increase in the rate per pound. Again, if coal or steel or labour becomes dearer, a railway has to pay the enhanced price, like any other consumer; all it can do is to use the article purchased as economically and sparingly as possible. Nor does it appear to strike a certain class of critics that increased working expenses are a direct and necessary consequence of the doctrines they preach. A railway company one year is accused of "financial profligacy" in charging a certain item to capital, not to revenue; next year it listens to the advice showered upon it, and charges the item to revenue. The result, naturally, is an increase in the ratio of working expenses to gross receipts.

To sum up: though there has been a huge increase in the paid-up capital of the railways, the gross receipts have increased at least proportionally, but the net amount available for the payment of interest and dividends has relatively decreased, because a larger proportion has been absorbed by the expenses of working and maintenance. In recent years the high prices of fuel and materials, and the gradual advance in wages (or, what is the same thing, the shortening of the hours of labour), have had a marked effect on expenditure. In addition, the remuneration obtained by the railways for the services they render has been diminishing, and they have to do more work in order to earn the same money. The Railway and Canal Traffic Acts of 1888 and 1894, together with the complementary enactments of 1891 and 1892, undoubtedly on the whole meant a reduction in the charges for the carriage of goods; and the profits of the passenger traffic, seriously curtailed by the reduction of fares brought about by the Midland's action in 1872 and 1875, are being further eaten into by continuous improvements in speed and accommodation, and, in populous areas at least, by the spread of electric tramways. These last may sometimes prove beneficial as feeders, but it is certain that they have abstracted millions of passengers from the railways—though not a very lucrative class of passengers—and in one instance, in Glasgow, they have necessitated the complete abandonment of a suburban railway service.

With regard to the future, the railways may fairly regard the prices they paid for fuel in 1900 and 1901 as abnormal; but they need not look forward

to any reduction in wages, or to any general increase in their rates for carrying passengers and goods. Their hope must rather lie in greater economy of operation. In goods traffic, they are alive to the fact that longer and more fully loaded trains make for such economy, and many of them are succeeding to a considerable extent in reducing their train-mileage while increasing their gross receipts, but they are hampered in their efforts at improvement by the peddling, retail method of business affected by the traders of this country. In long-distance passenger traffic, also, fuller loading is an advantage which might be obtained in certain instances by agreement between competing companies to limit the number of trains running by different routes between the same places, though the requirements of intermediate stations and the high standard of service now demanded by the public might render the reduction a good deal smaller than is sometimes supposed possible. In short-distance suburban traffic something may be hoped for from the introduction of electric traction, which presents the great advantage that it is peculiarly adapted for giving a frequent service—a feature in which steam trains apparently cannot compete with it on equal terms, but one which does much to stimulate the development of traffic. For local traffic on country branches, some companies—*e.g.*, the London and South-Western, the London, Brighton, and South Coast, and the Great Western — are experimenting with automobile coaches, the engine and passenger accommodation being combined on one car, and so far the results are encouraging,

the working expenses being reduced and a more frequent service rendered possible by their substitution for ordinary trains.

The first railway in this country to adopt the electrical solution and abandon steam locomotives was the Mersey in Liverpool, which started its electrical career in May 1903. Its example is being followed by its neighbour, the Wirral, by the Metropolitan and Metropolitan District in London, and by the North-Eastern and the Lancashire and Yorkshire for some of their suburban lines. Other railways, although they have not yet come to any definite decision, are known to be considering the advisability of introducing electrical propulsion over their local passenger lines, and a Clearing House Conference has already met to discuss the question of fixing a standard position for the conductor rail or rails. One difficulty which their deliberations brought to light was the fact that the position which would be the best and most convenient for the northern lines is impracticable for some of the southern ones. As to electrical traction for long-distance express trains and for heavy goods traffic, there are not wanting men who believe that it will eventually come. For the present, however, it is scarcely within the range of practical railway politics; and many difficult questions, both financial and engineering, will have to be answered before the steam locomotive finally disappears from our main trunk lines.

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