THE·WAYS·OF·OUR RAILWAYS

CHARLES · H · GRINLING

THE WAYS OF OUR RAILWAYS.

"ATLANTIC" TYPE OF EXPRESS PASSENGER ENGINE, G. N. R.

THE WAYS OF OUR RAILWAYS.

BY

CHARLES H. GRINLING.

AUTHOR OF "THE HISTORY OF THE GREAT NORTHERN RAILWAY," ETC.

Illustrated from Photographs.

WARD, LOCK & CO., LIMITED,

LONDON, MELBOURNE AND TORONTO.

1910.

CONTENTS.

List of Illustrations.

DIAGRAMS IN THE TEXT.

PREFACE.

MY object in compiling the following pages has been to describe and depict, in a simple and graphic way, the machinery and methods by which the railways of the United Kingdom are operated at the present time. My aim being to set forth the most approved practice only, I have thought it best to divide my subject with reference to the principal departments of railway activity, and not under the titles of the leading companies. Methods, of course, vary on different lines, and whenever it has seemed to me to be an open question as to which company, or set of companies, had adopted the best practice, I have mentioned the alternatives. In those departments in which some of the companies are notably ahead of the others, I have drawn my examples mainly, and sometimes solely, from the superior exponents of those branches of the art of "railroading."

Much of the material required for this volume could be obtained only by application to the officials of the railway companies. By such applications (in every case most courteously responded to) I have placed myself under many obligations, which I most gratefully acknowledge. I have striven, however, not to sacrifice my impartiality thereto, but by carefully sifting the information supplied to me from official sources, to present a picture which should not seem too rose-coloured when looked at from the standpoint of an everyday customer of the lines.

Both in the design aud execution of the book I have received constant advice and assistance from Mr. C. E. Grasemann, to whom I tender my warmest acknowledgments. A portion of Chapter III was written, at my request, by Mr. Edward Davy Pain, and a portion of Chapter IV by Mr. C. J. Bowen Cooke, to both of whom my sincere thanks are offered for giving me the benefit of their literary skill as well as of their expert knowledge. In writing each one of the other chapters I have had the assistance of one or more friends closely in touch with the department of railway working under treatment. My gratitude to these for help, in every case most kindly and willingly given, is none the less sincere because I do not mention them by name.

In conclusion, I should say that this is not intended to be a technical work. I have endeavoured to avoid all terms not included in the vocabulary of ordinary everyday life. The standpoint of the reader is assumed to be that of one who seeks information on a subject, which touches modern life at so many points, as to make a general knowledge of its principles and practice, most interesting and useful.

Preface to Popular Edition.

THE death of Mr. Charles H. Grinling in 1906, shortly after the first issue of this work, robbed the world of a brilliant and industrious writer who was known far and wide for his exhaustive knowledge of railways and railway matters. "The Ways of our Railways" having met with a very favourable reception from those best qualified to judge its value, and having come to be regarded as, in its way, a railway classic, a desire has been expressed for a somewhat cheaper edition, suitable for presentation to boys and other recruits to the great and ever-growing army of enthusiasts on the subject.

In the present issue no attempt has been made to bring up to date the statistics and other data supplied. Such figures and particulars of necessity vary from year to year, and are of little real importance compared with the general principles of railway working, which are here so clearly and in so interesting a manner expounded.

October, 1910.

THE LIMITED EXPRESS TO CORNWALL, G. W. R.

(Runs from Paddington to Plymouth without a stop—246 miles in 265 minutes.)

THE WAYS OF OUR RAILWAYS.

CHAPTER I.

The Constitution of the Companies.

"HOW many railway companies are there in the United Kingdom?" would be a question which would "floor" most examinees, if set in a "general knowledge" paper. Everybody knows the names of the great lines—London and North-Western, Great Western, Midland, Great Northern, and so on; but few people, I fancy, would be able to name off-hand as many as fifty railways in Great Britain and Ireland. Those who could do this would, perhaps, allow fifty more for lines they might never have heard of, or the names of which they had forgotten, and "chance" the answer to the question as "About one hundred."

As a matter of fact, there are double that number in England and Wales alone, and about twenty-five each in Scotland and Ireland, making a total of fully two hundred and fifty separately constituted companies, between whose ownership are divided the 22,600 miles of our railway system. The properties of about one hundred of these companies, however, are what are known as "leased" or "worked" lines. In both these cases the working of the traffic is carried on by a company owning an adjacent railway. The basis of a lease is usually the payment of a guaranteed dividend by the working to the owning company, whereas a simple working arrangement is usually based on a percentage division of the gross receipts between the two. There are also about twenty-five companies included in the total of two hundred and fifty whose capital has not yet been issued, and whose lines are therefore unmade, whilst several small lines have been allowed by their owners to become derelict.

As is well known, the tendency of British development has been for the lines to be constructed by small companies of local promoters, and subsequently amalgamated or absorbed into larger systems. The Great Western Railway Company, for example, has built up its great system of 2,736 miles—the longest in the United Kingdom—by swallowing nearly two hundred lesser companies. Yet, notwithstanding amalgamations, leases, and working arrangements, there still remain a number of small railway companies up and down the country whose spratlike undertakings have, for various reasons, failed to tempt the appetites of the whales of our railway world. Some of these, of course, owe their independence to some peculiarity in construction or motive power which tends to isolate them from their neighbours. To this class belong the London tubes, the overhead railway in Liverpool, the toy lines which wind round the mountain sides in North Wales, the cable subway in Glasgow, and that Irish freak—the Listowel and Ballybunion mono-rail—which a year or two ago, it was thought, might turn out not to be a freak after all, but the father of the railway of the future—the so-called "lightning express." But, in addition to all these, there are several companies who continue not only to own, but to work, surprisingly small standard lines. The least of this class is the Easingwold Railway Company, which since 1891 has worked a line two and a half miles in length, in the North Riding of Yorkshire, and whose total rolling stock consists of one locomotive and two passenger carriages. Compare this with the London and North-Western's stock of 3,055 locomotives and 84,382 other rail vehicles. Then there is the Bideford, Westward Ho! and Appledore Railway, with five miles of line, three locomotives, and thirteen vehicles; or, to take a little larger example, the Colne Valley and Halstead, whose nineteen miles of line are like an island in the midst of the Great Eastern's sea.

Nevertheless, the bulk of the railway system of the United Kingdom is concentrated in the hands of a comparatively few companies. The undertakings comprising more than a hundred miles apiece are eighteen in England and Wales, and five each in Scotland and Ireland. Three of the English eighteen are under the control of Joint Committees of the Boards of some of the others—*viz.*, the Midland and Great Northern Joint Railway, the Cheshire Lines (which are the joint property of the Midland, Great Northern, and Great Central), and the Somerset and Dorset (which is "joint" between the London and South-Western and the Midland). This leaves only fifteen separate companies in control of nearly 14,000 out of the 15,358 miles of railway in England and Wales.* In Scotland, practically the whole system of 3,580 miles is divided between five working companies, with the qualification that two of the big English companies—the North-Western and the Midland—assist the Caledonian and the Glasgow and South-Western in the management of the Portpatrick and Wigtownshire Joint line, which is eighty-two miles in length. In Ireland, one railway—the Belfast and Northern Counties—249 miles in length—has since July 1st, 1903, been the property of the Midland Railway Company of England; and another, the Dublin, Wicklow, and Wexford—144 miles—is closely connected with the London and North-Western. The three remaining big companies account for over 2,000 of the 2,985 miles, which (exclusive of State-aided "light" lines) comprise the railway system of Ireland.

In point of capital and income—though not in length of mileage—the London and North-Western

* I reckon the South-Eastern and London, Chatham, and Dover as virtually one company, though they retain separate constitutions for certain very limited purposes.

Table Illustrating Constitution of Railway Companies in England and Wales Owning over 100 Miles of Line.

N.B.—Most of the following figures were supplied to the Author direct by the Companies; the others are taken from the latest Government Returns.

Name of Company.	Length in Miles.	Paid-up Capital.	Shareholders. Number.	Shareholders. Average Holding.	Number of Locomotives.	Number of Other Vehicles.	Number of Engine Drivers and Firemen.	Number of Guards and Brakesmen.	Number of Signalmen.	Number of Ticket Examiners.
England and Wales.		£		£						
Cambrian	280	6,260,952	3,147	1,989	99	2,799	220	65	57	5
Cheshire Lines	140	...	...	...	...	...	...	168	363	60
Furness	139	7,740,968	6,375	1,214	130	7,952	212	47	100	9
Great Central	504	45,643,150	30,035	1,046	1,063	32,617	2,790	783	1,048	98
Great Eastern	1,128	54,178,130	35,020	1,452	1,085	32,207	2,270	756	1,302	118
Great Northern	832	58,107,569	34,521	1,683	1,279	42,006	2,613	1,179	1,439	188
Great Western	2,736	92,034,706	58,380	1,516	2,330	71,677	5,862	2,530	3,098	320
Lancashire and Yorkshire	583½	67,584,259	33,718	2,004	1,451	36,027	2,086	1,080	1,740	149
London and North-Western	1,946	122,636,856	78,165	1,541	3,055	84,382	6,865	2,311	2,958	281
London and South-Western	1,009	45,384,597	26,517	1,776	736	18,404	2,010	849	1,181	262
London, Brighton and South Coast	487	28,865,092	21,770	1,231	535	13,654	1,111	592	639	205
Midland*	1,631	192,054,059	75,793	2,379	2,931	124,505	7,260	3,368	3,250	150
Midland and Great Northern Joint	182	1,200,000	1,366	878	101	934	164	79	148	5
North-Eastern	1,682	77,654,267	56,527	1,374	2,000	104,544	3,973	1,524	2,270	236
North Staffordshire	203½	10,453,973	6,729	1,554	167	6,833	392	234	292	15
Somerset and Dorset	101	2,456,209	412	5,961	84	1,537	143	57	78	3
South-Eastern and Chatham	624	30,685,323 (S.E.) 27,773,752 (Chat.)	17,371 (S.E.) 15,633 (Chat.)	1,720 (S.E.) 1,773 (Chat.)	734	15,766	1,683	999	984	134
Taff Vale	124	9,421,460	6,549	1,438	198	2,905	478	325	271	16

* To which should be added the figures of the Belfast and Northern Counties Line, given under the head of "Ireland."

TABLE ILLUSTRATING CONSTITUTION OF RAILWAY COMPANIES IN SCOTLAND AND IRELAND OWNING OVER 100 MILES OF LINE.

N.B.—Most of the following figures were supplied to the Author direct by the Companies; the others are taken from the latest Government Returns.

Name of Company.	Length in Miles.	Paid-up Capital.	Shareholders. Number.	Shareholders. Average Holding.	Number of Locomotives.	Number of Other Vehicles.	Number of Engine Drivers and Firemen.	Number of Guards and Brakesmen.	Number of Signalmen.	Number of Ticket Examiners.
Scotland.		£		£						
Caledonian	1,034	66,078,468	38,995	1,598	902	67,853	2,249	1,147	1,221	145
Glasgow and South-Western .	416¾	18,443,004	13,900	1,327	390	18,981	1,018	424	502	91
Great North	336	7,600,929	5,740	1,174	115	4,305	186	105	140	24
Highland	485	6,772,103	7,285	932	146	3,338	250	102	179	5
North British	1,318	63,800,819	33,841	1,788	841	68,448	2,573	1,299	1,363	177
Ireland.										
Belfast and Northern Counties*	249	2,896,049	3,724	777	82	2,709	173	46	71	8
Dublin, Wicklow, and Wexford	161	2,523,377	3,194	790	58	1,214	98	43	79	7
Great Northern	533	8,190,606	9,100	871	157	5,340	302	116	233	22
Great Southern and Western	1,083	13,605,084	15,012	874	282	7,725	517	169	340	33
Midland Great Western . .	538	6,510,361	8,312	783	138	3,350	214	95	171	14

* This line now forms part of the system of the Midland Railway Company.

is the premier railway company of the United Kingdom. The Midland, it is true, has a nominal capital of 180 millions, as compared with the 121 millions of the North-Western; but, whereas the whole of the latter sum had actually been subscribed and expended in cash, nearly 74 millions of the Midland's total is what is vulgarly known as "water." To water the capital of a company is to credit the stockholders with the possession of amounts of stock in excess of those for which they have actually paid. In most cases where our railway companies have resorted to this device, the "watering" process has been accompanied by "splitting"—*i.e.*, the stocks have been converted into equal or unequal parts, called respectively "preferred" and "deferred." The object of this last-named operation, which was initiated by the Great Northern Railway Company as long ago as 1848, is to attach a practically assured dividend—usually four per cent.—to the preferred part of the holding, leaving the deferred as a speculative attraction for Stock Exchange operators. It was found that holdings thus divided gained in value on the market, and "Conversion Trusts" were formed to buy up large blocks of stock and split them unofficially. Several of the large companies thereupon decided upon official conversion, but this policy has lately received a check by the action of the Inland Revenue Commissioners in demanding the payment of stamp duty upon the nominal increase. By a decision of the House of Lords in 1902, the Midland Railway Company was adjudged to pay a total sum of £108,000 under this head, together with the costs of prolonged litigation with the Commissioners. By issuing stocks at a discount, many of the companies have created nominal capital, but the amount of this has probably been fully offset by the premiums on their issues received by the more prosperous concerns.

In round figures, one thousand million sovereigns have been sunk in the railway system of the United Kingdom, and were the British Government to decide to buy up the companies' properties as going concerns—under the terms of the Railway Regulation Act of 1844—the price fixed would probably considerably exceed that sum.

The gross revenue of the companies for 1904 was nearly 112 million pounds, and, after deducting working expenses, the net receipts were £42,639,000. A few specially favoured undertakings pay high dividends, but on the capital as a whole the return is quite moderate, viz., about $3\frac{1}{2}$ per cent., and some unlucky companies have been unable to make any distribution at all to their ordinary shareholders for many years past.

The railway capital of the United Kingdom is divided into about 800,000 share-holdings, the owners of which are the nominal rulers of this vast national property. The theory is that two-thirds of the money spent upon a railway goes in the construction of the permanent way, stations, etc., and the other third in the purchase of the equipment; and Parliament allows loans to be raised to the extent of the value of the latter. The people who provide these loans—known as the debenture-holders—can, of course, foreclose if their interest be not paid, and put in a receiver to intercept the revenue, but, apart from such extreme measures, they have no control over the administration. This rests with the "preferential" and "ordinary" shareholders, who, in theory, govern our railways as completely as the Houses of Parliament govern the country.

But just as our real Government consists of the Ministers of the Crown, so the real administrators of the railways are the directors. These directors are, of course, themselves shareholders, just as the members of the Government are also members of Parliament; but in neither case does the appointment of the executive actually come from the deliberative body. The Crown appoints the Ministers; railway directors appoint their own colleagues. When a vacancy upon a railway Board occurs, a new director is chosen by the remaining members from the list of shareholders on the register; the general body of shareholders have no voice in the matter. But, just as a Constitutional Government cannot exist without the support of a majority in Parliament, so a railway Board cannot live without the confidence of a majority of the shareholders. At every shareholders' half-yearly meeting the names of certain directors who retire by rotation are submitted for re-election, and this rule affords constantly recurring opportunities of testing the confidence of the proprietors in their executive. In the ordinary way changes in railway Boards are brought about by death or voluntary retirement, but in numerous cases votes of no confidence have been passed at the half-yearly and other occasional meetings, and a part or the whole of the directors have consequently resigned or been dismissed, to make room for others more acceptable to the general body of the shareholders. Moreover, the shareholders directly nominate and elect the auditors, whose special duty it is to see that the Board does not deviate from the paths of sound finance.

The ordinary meetings of the shareholders are held twice a year, about a week after the issue of the directors' report on the previous half-year's working. "Extraordinary" or "special" meetings are also occasionally held at other times, but in cases where the special business is merely a formality required by law, and not a real exigency of the company's business, these extraordinary meetings are commonly held immediately after the ordinary proceedings, to save trouble to all concerned. Meetings of shareholders held to approve Bills promoted by railway companies in Parliament are frequently called "Wharncliffe" meetings, after the peer of that name, who was responsible for the enactment making such approval necessary.

As there are 78,000 shareholders in the London and North-Western Railway Company, nearly 76,000 in the Midland, and over 58,000 in the Great Western and North-Eastern, it might be thought that the largest halls in the kingdom would have to be re-

THE ENTRANCE TO EUSTON STATION, LONDON, L. AND N. W. R.

THE BOARD ROOM, PADDINGTON STATION, LONDON, G. W. R.

quisitioned for the half-yearly meetings of these and other large railways. As a matter of fact, most of the great companies have halls on their own premises big enough to accommodate the very small percentage of proprietors who usually take the trouble to attend these railway parliaments. As a rule, the gathering consists of a hundred or so shareholders—mostly men, but with here and there a member of the gentler sex—reinforced by a dozen or so of the company's staff at the back of the room, and some twenty or more reporters who, with their pencils and note-books, range themselves on the outer side of the directors' table. Punctually at the appointed hour the chairman enters the hall from an anteroom, followed in single file by his colleagues, the principal officers of the company bringing up the rear. The directors seat themselves in a row at the table facing the reporters, the chairman taking the middle place, with the secretary on his right and the solicitor on his left. Immediately behind him sit the general manager and the accountant—to prompt him, if necessary—and the other officers sit or stand farther in the rear. The secretary rises at the chairman's call to read "the notice convening the meeting." Next, the chairman affixes the seal of the company to the register of shareholders, perhaps adding some information as to how their numbers stand as compared with the date of the last gathering. Then he commences his half-yearly address, which usually lasts from half an hour to an hour.

The delivery of a successful half-yearly speech by a railway chairman is a duty requiring the exercise of considerable ability and tact. Particularly is this the case when the dividend is "down" and the shareholders have assembled with a sense of grievance. They listen to the chairman's explanations in stolid silence, and where he had mentally counted upon an encouraging "Hear, hear," not a note of approbation is heard. A strong chairman will, under these circumstances, seek to disarm criticism by himself dwelling upon such unfavourable symptoms as promise amendment in the near future, thereby at once administering solace to the shareholders and diverting attention from the really unhealthy symptoms—if any—as to which it would be awkward were enquiry to be made. A less tactful speaker will endeavour to make out that all is *couleur de rose*, and so give the critics openings which more skilful handling would have closed to them. A magnetic chairman—and these are the men who make great names in the world of companies—will so pervade the whole atmosphere with his own cheery optimism that in half an hour the ill-humour of the meeting will have vanished and the shareholders will be laughing heartily even over their own misfortunes.

After the chairman's speech, and the formal seconding by the deputy-chairman of the motion for the adoption of the report and accounts, comes the opportunity for the oratorical shareholder. There are some half-dozen men, and at least one woman, who, owning shares in a large number of railway companies, the dividends on which apparently relieve them from the necessity of regular work, find occupation for a couple of weeks in each year in attending railway meetings and indulging an innate propensity for speechifying. These individuals, when not too long-winded, afford comic relief to otherwise monotonous proceedings ; but, beginning as amusing cranks, one or two of them have degenerated, under the encouragement of indiscreet applause or mention in the Press, into the category of insufferable bores. Their inconsequent and trivial remarks cast discredit upon the value of shareholders' criticisms, and discourage better-informed speakers whose comments might be serviceable.

Another class of time-wasters at railway meetings are the shareholders with local or personal grievances, who catechise the chairman as to the unpunctual running of particular trains, the alleged inadequacy of the service in their own neighbourhood, or the want of deference shown to them by the station-masters or porters. Such complaints as these should properly be addressed to the general manager, and no wise chairman allows himself to be lured into a discussion of them at the half-yearly gatherings ; but the shareholder with a crotchet is hard to repress. On the other hand, the persistent heckler—so well known at political meetings—is not very often heard at the railway parliaments ; and it is somewhat astonishing how often matters of vital importance to a company are altogether ignored, both in the chairman's speech and in the subsequent discussion. The explanation probably is that the well-informed shareholder usually understands the value of reticence in business matters, while the talker has not enough knowledge to enable him to "touch the spot."

In truth, the really influential railway shareholders are generally those who attend the meetings only by "proxy." Whenever an important issue has to be decided, on which the directors are in any doubt as to the views of the shareholders, they take pains to fortify themselves with a goodly collection of papers in the following form: "I, John Smith, one of the proprietors of the Great North, South, East and West Railway, do hereby appoint"—here the name of the chairman of the company will be inserted—"to be my proxy in my absence to vote in my name in such manner as the said proxy shall think proper, upon any matter or question which shall be proposed at the forthcoming general meeting of the proprietors of the said company," etc. If the signatures to these forms of proxy represent the holders of a majority of the preferential and ordinary shares, then the directors know their seats are safe; nevertheless, the chairman usually does not reveal the strength of his position, but endeavours to get the policy of the Board confirmed in open meeting. Should there be an organised opposition which also holds proxies, a poll will be demanded; and then is the time for the chairman to announce the voting power at his back. If this be insufficient to give an absolute majority to the Board, scrutineers have to be appointed, and the votes of all the shareholders present are taken down to add to the proxies. As a rule, however, the proxies alone are sufficient to give an absolute majority either to the Board or to their opponents, in which latter case, of course, the resignation of the Board is the necessary consequence.

A directorship of a British or Irish railway is a coveted position, not mainly on account of the salary attached—which is seldom more, and generally less, than £500 a year—but for many other reasons. For one thing, the very *élite* of the land—the Royal Family only excepted—meet in the railway Board-rooms, and it is pleasant to be able to claim a duke or an ex-Cabinet Minister as one's colleague in business. To be permitted to travel free over the railways of the land by virtue of a gold medal dangling from one's watch-chain is also an agreeable thing in its way. But the vast majority of our railway directors have taken office for much weightier reasons: either they have large family holdings of the companies' stocks to look after, or the efficient working of the railway and the timely extension of its facilities are of vital importance to their own businesses. The former is the explanation of the presence on railway Boards of so many holders of great and honoured names; the latter of the large intermixture of the commercially trained element. The resultant blend would be hard to beat—aristocratic integrity and independence combined with business training, commercial acumen, and local knowledge. In a few companies the chairman is a financial "expert," with a special fee; but this practice has fallen somewhat into disrepute since the days of George Hudson and Edward Watkin. The titled chairman is now in favour, and several of the largest companies are headed by members of the House of Peers; others by younger sons of noble families, and others by baronets or knights. Some of these titles have been won by the holders as rewards for eminence in the commercial world, others are hereditary; for excellent railway chairmen have been "born" as well as "made," and no class has a monopoly of the output. Officials who have grown grey in the service are frequently promoted upon retirement to seats on the Board, to which they contribute a kind of knowledge the more valuable because it forms part of the blend afore-mentioned. In several cases a man who entered the service of a British railway in a humble capacity has ultimately risen to be its chairman. "Expert" appointments of this kind are usually highly successful.

The London and North-Western has twenty-four directors, but no other of our railways has more than twenty, and a dozen is a favourite number. Meetings of the full Board are usually held once a month, but in addition there is a good deal of committee work to be done. The directors' committees, consisting of a delegation from the full Board, with each a regular chairman, are classified as "Ways and Works," "Locomotive," "Traffic," "Finance," "Parliamentary," "Hotels," "Docks and Steamboats," and under other heads, according to the size of the company and the variety of its operations. The Finance

Committee, which passes and pays accounts, usually meets weekly; the others once or twice a month as business may require. The responsible officers of the various departments attend and report to these Committees, who in turn report to the full Board.

The fact that the chairman and directors of British railways are not, as a rule, high-salaried experts, like the president and vice-presidents of the American roads, has made the position of general manager on our railways one of the first importance. The salaries paid by the great companies to their general managers range as high as £5,000 a year, and in the hands of a strong and capable man, who possesses the full confidence both of directors and shareholders, the power wielded is, in its own sphere, almost unlimited. The work and responsibility are, of course, correspondingly great. "The first discovery that anyone makes on being appointed to such a post," said Sir George Findlay, of the London and North-Western, himself one of the best of English railway managers, "is that if the day consisted of forty-eight hours instead of twenty-four, and every hour were devoted to his office, his time would still be insufficient to meet the demands on it." One of the maxims Findlay laid down for economising time was: "Always make a point of refusing (except, of course, in special circumstances) to see chance callers." With a view to the strict observance of this rule, the general manager's room is usually approached through at least two others, the outer one being occupied by some of his ordinary staff, and the inner one by his head clerk. One of the qualities which make a head clerk to a general manager precious to his chief is a fertility of resource in "heading off" pertinacious callers. "The man who has had a box delayed, the woman who conceives she has been overcharged in her fare, the discharged footman who seeks employment as a porter, will each and all," said Findlay, "insist upon seeing the general manager, and the rule" (*i.e.*, not to see callers except by appointment) "can only be maintained inviolate by the agency of a wily and imperturbable secretary, and an office which can only be approached through his."

The servants directly employed by the railway companies of the United Kingdom are classified as follows in the latest Board of Trade return :—

Stationmasters	8,103
Brakesmen	15,708
Permanent-way men	66,621
Gatekeepers	3,507
Engine-drivers	25,556
Porters	55,276
Shunters	10,841
Firemen	24,083
Inspectors	6,772
Passenger guards	7,291
Signalmen	28,496
Labourers	53,282
Ticket-examiners	3,642
Mechanics	81,440
Other classes	185,216
	575,834

Several of the larger companies have from 50,000 to 80,000 people in their employ, and the organisation of so vast a staff is a matter of great difficulty. As already stated, authority over all grades in the service is concentrated in the general manager, except in cases where for special reasons the heads of certain departments have the privilege of taking their instructions direct from the Board. This is sometimes done when the solicitor, estate agent, or other official not directly concerned with the working of the railway, has special claims upon the consideration of the directors. Cases have also occurred when for a time such officers as the chief engineer or the locomotive superintendent have been allowed to administer their departments without control by the general manager; but such arrangements are exceptional, and it is recognised that they do not make for efficiency. In but few instances, however, are general managers thoroughly qualified by knowledge and training to supervise the work of the technical as well as of the commercial departments; and inasmuch as most head officers in the railway service rise from the ranks, there is need of more systematic training in the earlier stages, and the breaking down of some of the barriers of departmentalism which prevent the acquirement of all-round experience. A certain basis of training in the engineering and mechanical schools might perhaps be made almost a *sine qua non* for advancement to the higher posts, without absolutely removing that ladder up which some of the best of our railwaymen have laboriously toiled rung by rung from the cart-tail, the lamp-room, or the ticket-sorting office to the general manager's chair.

The majority of our present-day general managers received their training in the traffic department, but there is no royal road to the premiership of a British railway. There have been several modern instances of a company's solicitor being appointed; for, in the case of every railway, the legal officer has opportunities for gaining an insight into the company's affairs and policy second only to those of the general manager himself. This arises from the fact that every important step in the development of the undertaking requires the sanction of Parliament. Moreover, in addition to the almost yearly private Bills which it is necessary for railway companies to promote, there are many general Acts for the regulation of the working of railways, their charging powers, their relations with their *employés*, and many other matters. So large and important is this Parliamentary business that every considerable company has an office at Westminster, where, during the Session, the general manager and solicitor are almost as often at work as at their headquarters. The inaccessibility of a general manager to casual callers at his recognised centre of activity has been already referred to, but these high magnates "you may meet by twos and threes in every street," if you go down to Westminster when the Private Bill Committees are in full session. If you pass into the House through the Strangers' Lobby and climb the staircase to the Committee Room floor, you will find a long corridor thronged with managers, engineers, solicitors, agents, and bewigged counsel, the majority of whom are there on the business of the railway companies. Consulting the official notice-board, you may find that the Great North, South, East, and West Railway Company's Bill is engaging the attention of a House of Commons Committee in Room X, presided over by Mr. Blank, M.P., assisted by four or five other members who have all solemnly declared at the outset that they are not holders of the railway company's shares. Entering the room, you will find the members of the Committee seated round a horseshoe table, within the curve of which sits the general manager of the Great North, South, East, and West Railway undergoing cross-examination by an eminent K.C., representing another railway company which is opposing the Bill. Close behind the eminent counsel sit or stand the solicitor and general manager of the opposing company; and perhaps two or three other "G. M.'s" are listening to the case and waiting their turn to go into the witness-chair as experts on the one side or the other, while solicitors, engineers, agents, and their satellites hover around.

The Committee rises for lunch—a modern concession to the degenerate digestions of members of the Commons. Noble Lords, when engaged in Committee work, have plates of cold meat, sandwiches, and whisky-and-sodas brought to them where they sit, and the case goes on uninterrupted from 11 or 11.30 to 4. But the Commons' Committees usually rise for half an hour about 1.30, and while the members go down in the lift to their well-appointed dining-room, the parties engaged on the Bill make their way to one of several refreshment-bars adjacent to the corridor and the staircase. Hunger prompts you to follow, and you find yourself standing at the counter alongside the general manager of the Great North, South, East, and West Railway—and if you have the privilege of a slight personal acquaintance with that distinguished man—discussing with him pressed beef and the weather. Your friend the inventor, who is interested in a patent carriage window-opener or automatic ticket-issuer, and who has made vain attempts for weeks past to persuade the "wily and imperturbable secretary" who guards this general manager's door, to allow him to show this epoch-making invention to the great man within, vows to go to Westminster next day with the model in his pocket; but, alas! he chooses an "off" day when no railway Bills are under consideration, and your character for veracity is, in his eyes, grievously impaired.

But when the general manager gets a day off from the Committee Rooms, he is not always at liberty to spend it at his headquarters office overtaking the arrears of work which will have accumulated during his absence at Westminster. He may have a case on before the Railway Commission or the Light Railway Commission—two important tribunals which, despite the similarity of their names, exercise very different functions. The Railway Commissioners hold their sessions at the Royal Courts of Justice, their president being one of the judges of the High Court, while the other two members are laymen. Not many of the visitors who frequent the Law Courts as sightseers, or in the hope of hearing piquant details in a *cause célèbre*, find their way into the Court where the Railway Commissioners are sitting, and those who do are speedily sent away by the depressing dulness of the proceedings therein. Disputes between railway companies and their customers as to rates, " terminals," or facilities, or between one railway company and another as to running powers or through routes, form the hard nuts which the Railway Commissioners have to crack at their periodical sittings, and for the cultivation of a headache there is no better place than their Court on a hot day. But some of the ablest counsel at the Bar are briefed in these complicated applications, and here again, as in the Parliamentary Committee Rooms, the railway general manager may have to undergo searching cross-examination both as to traffic details and legal subtleties.

In the Light Railway Commissioners' enquiries, which take place up and down the country wherever a scheme for a line " of secondary interest " is being promoted, the procedure is less formal ; but counsel are usually briefed, and evidence has to be taken, so that the general manager has yet another opportunity of exhibiting verbal dexterity in the witness-chair. No wonder it should be a current saying that every British railway manager becomes " half a lawyer " ; and no wonder that the companies' solicitors, whose close assistance is necessary on all these occasions, should sometimes be selected as the most fitting successors to the managerial positions.

In several recent instances the locomotive superintendent or the chief engineer of a great British railway has been promoted to the general managership, but in the majority of cases, as has been already said, the road to the premiership of one of our railways lies through what is known as the traffic department. The fundamental difference between this department and those of the engineer, locomotive superintendent, or estate agent is that the traffic staff make and sell the commodity in which a railway company deals—*viz.*, transportation—whereas those other departments merely make and maintain the tools with which that commodity is manufactured. Under the normal scheme of British railway organisation, the general manager, as has been already stated, stands between the directors and all the other officers, but he is specially head of the traffic department, which, as a whole, has no other head but him. In some recent cases, however, a new appointment—that of "chief traffic manager"—has been created.

On most of our railways the traffic department has two chief officers, ranking equally under the general manager and bearing the titles of "chief goods manager" and "superintendent of the line." Each of these officers has one or more "assistants" at headquarters, while at various convenient centres "district managers" and "district superintendents" coexist, each representing one of the two branches of the department. The general line of demarcation between the two branches is expressed by the words "passengers" and "goods"; but whereas the goods manager and his staff concern themselves solely with work proper to their titles, the officers of the superintendent's department are responsible for the running of the freight trains as well as of the passenger trains. This seeming anomaly arises from the fact that it is impossible to divide the control of trains which run over the same metals; and, therefore, it is only when the goods trains are actually in the goods stations, loading and unloading, that they are in the charge of the goods manager's staff; as soon as they emerge upon the running lines they fall under the control of the superintendent of the line, whose department arranges all the time-tables and signalling arrangements. But while the signalmen, and all the guards and brakesmen—both passenger and goods—belong to the superintendent's department, the engine-drivers and firemen are under the locomotive superintendent, and the plate-layers, except when engaged in "fogging," form part of the staff of the engineer.

This is the normal and old-established type of British railway organisation, and its efficiency has been tested by many years' experience. Admittedly, however, it contains anomalies, some of which, within recent years, the authorities of the North-Eastern and Great Northern companies have endeavoured to remove by devising a new sub-division of the traffic department under the heads "operating" and "commercial." By this arrangement the department formerly known as that of the superintendent of the line is enlarged to embrace control of the whole of the operations connected with the working of the trains, including the management of the goods stations, the chief operating official being entitled "general superintendent," while his subordinates are known, as before, as assistant superintendents and district or divisional superintendents. The commercial department, on the other hand, takes over all the office duties—that is to say, the duties not connected with the actual working of the trains—both from the goods and passenger side of the old classification; but as a subdivision of this department this classification is still retained, the chiefs of each branch holding the titles of "goods manager" and "chief passenger agent" respectively. Finally, it is sought, as already stated, to give a unity to the whole traffic department by the creation of a new head officer, with supervision over both the operating and commercial branches, whose title is "chief traffic manager."

There is no doubt some risk of the offices of general manager and chief traffic manager overlapping, especially in cases where the general manager has himself been drawn from the traffic department. In such cases the premier officer may find it difficult to give to the traffic manager that degree and range of independent authority which is essential to the success of this type of organisation. Old habits may tempt him to undertake work of detail, or to make

LORD ROBERTS UNVEILING THE MEMORIAL AT EUSTON STATION, LONDON, TO THE LONDON AND NORTH-WESTERN RAILWAY COMPANY'S MEN WHO FELL IN THE SOUTH AFRICAN WAR.

himself responsible for direct decisions in traffic matters—a temptation from which the chief traffic manager is himself not exempt when supervising and conducting the work of operating and commercial branches of the traffic department. But a general manager who succumbs to that temptation would by so doing prove himself unequal for the high post to which he had attained, and would throw away the main advantage claimed for this latest type of organisation, which seeks to relieve the principal officer, who must from the necessity of the situation be the thinking and directing brain of the system, from all work other than supervision. It is essential, under modern conditions, that the premier officer of so vast an undertaking as a great railway should not have his mind occupied with troublesome details, but should have plenty of time to think out and pursue broad lines of general policy, and to co-ordinate along those lines the work of all the various departments of the business.

A criticism which may be fairly urged against the new classification of a railway staff into operating and commercial departments is that the theory, if it be sound, might fairly be carried farther than has at present been done on any British line. The operating branch might be enlarged to embrace that section of the running staff which is at present under the control of the locomotive department, including the engine-drivers and the firemen and those officers who supervise the locomotive work on the "road." It might also be found advisable to transfer the permanent way inspectors and platelayers from the engineer's staff to the operating branch of the traffic department. Both these things are done on American railways, where an officer called "general superintendent of transportation" controls not only the working of the trains, but the manning of the engines and the supervision of the track. But to make the arrangement a success it is necessary that the operating officers should have a basis of engineering and mechanical knowledge, which, as already stated, is not commonly the case on our railways. It may well be that our normal type of organisation, which compels every traffic officer to do his share of commercial work, tends to encourage too exclusively the promotion of men with office training to the exclusion of those with technical knowledge. On the other hand, so long as our railways remain under the control of commercial companies, whose primary object is to earn dividends for shareholders, so long must business aptitude remain the passport to the highest posts.

AN OFFICE INTERIOR, EUSTON STATION, LONDON, L. AND N. W. R.

A GROUP OF RAILWAY PORTERS AT EUSTON STATION, LONDON, L. AND N. W. R.

CHAPTER II.

The Service of the Staff.

TAKING 600,000 as the approximate total of the railway *employés* of the United Kingdom at the present date, it is probable that rather more than one-half constitute the managerial and operating staff of the lines. About 200,000, or one-third of the total, are engaged in connection with the maintenance and renewal of the permanent-way and rolling-stock, and the remaining 80,000 are employed in looking after the various "side-shows" carried on by our railway companies, such as hotels, refreshment-rooms, docks, steamships, canals, etc.

It will be seen that "mechanics" form the largest of the classes of railway *employés* separately enumerated in the Board of Trade return quoted in the preceding chapter. Generally speaking, every railway company in the United Kingdom has found it advantageous to have its own repair-shops for locomotives, carriages, and wagons; and when repairs have to be executed on a large scale, necessitating the provision of large and costly plant, it is economical to manufacture new rolling-stock as well. The bigger companies make practically all their own locomotives, carriages, and wagons. The smaller ones do so up to the capacity of plant primarily provided for repairs and renewals, contracting with outside works for the balance of their requirements. A number of the companies manufacture their own signal apparatus, including cabins, signals, and locking. At Crewe, for example, about forty sets of signals and 6,000 yards of point-rodding are turned out monthly. At the same place the London and North-Western has its own steel-works, capable of producing 50,000 tons of steel per annum, with "cogging" and rail-rolling mills, from which, after passing through a variety of processes, the ingots finally emerge in the form of 60-ft. rail sections, weighing 90 lb. per yard. Quantities of steel girders are also made at Crewe for warehouses, roofs, footbridges, etc.; and on one occasion, when a viaduct was washed away and had to be hurriedly replaced, no less than forty-two girders, each 32 ft. long, were made within seven days. All this is in addition to turning out about two hundred new locomotives per annum, and executing the necessary repairs to the stud of over 3,000 engines employed by the North-Western Company.

The question whether British railway companies do not go somewhat too far in manufacturing for their own requirements is one which is often debated. The most serious objection taken to the present system is that it is a handicap to "standardising," and consequently not so economical to the railway interest as a whole, as if a few very large firms, like the well-known Baldwin Locomotive Company of America, were to supply the wants of all the companies from plant laid down on the largest possible scale with a special view to the production of a number of generally acceptable types. On the other hand, it is obvious that the English system allows of a closer adaptation of the locomotives and other machinery to the work which they have to do, as the rolling-stock of each company is designed and built under the direct personal supervision of the man who is responsible for its subsequent efficiency in working. Regarded from the workers' point of view, there are, as we shall see, substantial advantages accruing to the people employed, from the fact that they are directly the servants of the railway companies. On the other hand, it is somewhat of a handicap to locomotive-building as a national industry to have the bulk of the home trade carried on at private works, for this makes it increasingly difficult for British makers to hold their own with their American and German competitors in the foreign and Colonial markets, where the latter can, at times, "dump" the surplus of their much larger home production. In case, too, of a sudden "boom" in railway traffic, such as occurred a few years ago, it is perhaps more difficult for our railway companies to get their rolling-stock requirements promptly met under the present system, than if they always placed the majority of their orders with contractors.

As regards the construction of new railways, stations, etc., the employment of contractors is general throughout the United Kingdom, though occasionally small jobs are carried out by the companies' engineering departments with their own staff and plant. When the work is of any magnitude, the engineers on the staff of the companies have sufficient responsibility in regard to design and supervision, so that the employment of a contractor who provides "navvies," cranes, and other plant, makes both for efficiency and economy. There are at least 10,000 men regularly employed in the carrying out of railway construction in the United Kingdom, in addition to the 66,000 "permanent-way men" on the engineering staffs of the companies who look after the maintenance and renewal of the tracks.

It will be seen that railway employment embraces an immense variety of occupations. In its higher grades it demands the services of professional men of very varied training, whilst in the lower branches there is room for all degrees of skill in clerical and manual labour. I have before me a complete list of the various classes of *employés* in the service of the London and North-Western Railway Company, and I find that the number of different kinds of employment amounts to no less than 801. In the Traffic Department there are 135 classes, including such unexpected denominations as "book-carriers," "branders," "bullockmen," "chain-boys," "deliverers," "hookers-on," "iron-counters," "rope-shippers," "slippers," "tariffmen," and "winch-

HOTEL PORTERS, EUSTON, LONDON, L. AND N. W. R.

TRAIN AND DINING-CAR ATTENDANTS, WEST COAST ROUTE, L. AND N. W.
AND CALEDONIAN RLYS

men." The Permanent Way Department employs 114 classes, amongst them being "asphalters," "french-polishers," "grainers," "holders-up," "rammermen," "saw-sharpeners," and "wallers." Then there are sixteen more sorts in the Permanent Way Stores Department, including "ballast-guards," "chairgaugers," and "sawyers." The Canal Staff is another sub-department of the chief engineer, and its twenty-six classes of *employés* include "bank-rangers," "divers," "lock-attendants," and "water-agents." In the Electrical and Signal Department—which comes midway between the jurisdictions of the chief engineer and the locomotive superintendent—we find sixty-five kinds of men employed, amongst them being "chargemen," "strikers," "carboners," and "moulders." The Estate Department has fifteen denominations for its staff, of which "superintendent of labouring-class houses" would be difficult to understand, did one not know that railway companies have been called upon, in a number of instances, to provide model dwellings for labouring people, whose former habitations have been removed to make way for new lines and stations.

The Locomotive Department, which includes the Plant Works, is the largest employer of labour of all the sections into which railway service is divided. In the case of the London and North-Western, the staff of this department includes no less than 21,317 persons. There is, first of all, the Locomotive Works Department, which gives employment to fifty-eight classes of people, including mechanics of all kinds. Then there is the Running Department, including, besides the engine-drivers and firemen, over seventy other denominations of *employés*, amongst which "fire-carriers" and "fire-droppers" may be mentioned as illustrating the demand in the railway service for various orders of talent. The outdoor section of the Locomotive Department employs thirty-six classes of men, ranging from "blacksmiths" to "well-sinkers," whilst the Gas section requires fifteen other kinds, amongst whom "gasfitters" and "meter-inspectors" are naturally the most prominent. The Carriage as well as the Locomotive Department boasts a chemist and a photographer amongst the eighty classes of *employés* for which it finds service, and in the Wagon Department there are fifty-seven more denominations, including "scrap-pilers" and "wheel-glutters." The Marine Department naturally requires a staff ashore as well as a staff afloat, and there are forty-one classes of persons employed in the former, as against twenty-two in the latter. The General Stores and Sheeting Department contributes thirty-two classes to the total, and there are nine denominations on the roll of the Hotel Department, which requires a carpenter, an electrician, and a gardener, as well as a small army of domestic servants. Altogether, the London and North-Western Railway Company gives employment to no less than 82,835 persons, of which the following is a convenient general classification, although, as above shown, it does not take account of very many subdivisions :—

Principal officers	110
Brakesmen	2,139
Capstan-men	358
Capstan-lads	17
Carmen (adult)	3,657
Carmen (junior—*i.e.*, van-guards, etc.)	1,315
Carriage-cleaners (adult)	1,050
Carriage-cleaners (junior)	54
Carriage and wagon-examiners	368
Checkers (adult)	1,875
Checkers (junior)	45
Checkers, chain-boys, and slippers (adult)	20
Checkers, chain-boys, and slippers (junior)	51
Clerks (adult)	7,320
Clerks (junior)	1,953
Engine-cleaners (adult)	2,448
Engine-cleaners (junior)	533
Engine-drivers	4,085
Firemen	2,868
Gatekeepers	249
Greasers (adult)	97
Greasers (junior)	30
Guards (passenger)	629
Horsedrivers (shunting)	180
Inspectors (permanent-way)	68
Inspectors (others)	554
Labourers (adult)	9,290
Labourers (junior)	548
Lampmen	201
Lamp-lads	8
Loaders and Sheeters	673
Mechanics (adult)	10,948
Mechanics (junior)	2,138
Messengers (adult)	110
Messengers (junior)	495
Number-takers (adult)	42
Number-takers (junior)	95
Permanent-way men	7,276
Pointsmen (ground)	18
Policemen	103
Porters (adult)	6,151
Porters (junior)	1,135
Shunters	1,348
Signal-fitters and telegraph-wiremen	115
Signalmen	3,025
Signal-box lads	67

Station-masters and goods-agents	877
Ticket-collectors and examiners	265
Watchmen	72
Yardsmen	102
Foremen (permanent-way)	14
Foremen (others)	1,775
'Busdrivers	24
Point-cleaners	58
Stablemen and horsekeepers	327
Miscellaneous (adults)	3,067
Miscellaneous (junior)	395
	82,835

I may add that the number of female *employés* of the London and North-Western is 1,542, of which about 300 are clerks selected from daughters of company's servants.

The one general characteristic of railway employment, which is also its chief attraction, is its permanency. There are, it is true, a good many "supernumeraries" and "probationers" in the service; but when once placed upon the regular staff, a man, if he keeps steady and works with moderate efficiency, is usually retained until incapacitated by age, and in many grades he can reckon upon receiving a pension upon retirement. Even the men employed in the workshops are seldom discharged except for misconduct. The worst that befalls the railway mechanic who is on the regular staff is to be placed on "short time," and the men engaged in working the traffic and in the offices have not even this to fear. The difference in the staff requirements of busy and slack times is adjusted by engaging or discharging supernumeraries. The men

AN INSPECTOR, L. AND N. W. R.

THE STATION-MASTER, EUSTON,
L. AND N. W. R.

ASSISTANT STATION-MASTER, EUSTON.
L. AND N. W. R.

whose names stand on the regular pay-rolls know practically nothing of what depression of trade means to the generality of those who work for wages; nor do the higher officials feel that sense of insecurity in bad times which furrows the brows of salaried servants in some other spheres of employment. For permanency, railway service in the United Kingdom is practically as good as the service of the Government. But railway companies, unlike Government departments, have dividends to earn, and little or no "slackness" is tolerated amongst the *employés*. Whilst the pay of the railway servant is secure, and the employment lasting, the work is hard and the hours not light.

"The humblest railway servant, if he does not, like one of Napoleon's corporals, carry a marshal's bâton in his knapsack, may at least contemplate a field of possible promotion of almost as wide a scope." This statement of the late Sir George Findlay in his book, "The Working and Management of an English Railway," has been exemplified in the careers of many leading British railwaymen. Three of our present (1905) railway chairmen, Sir Charles Scotter, of the London and South-Western, Sir James Thompson, of the Caledonian, and Sir Henry Oakley, of the Central London, have risen from the ranks, as also did Mr. G. B. Wieland, the lately deceased chairman of the North British, and Mr. James Staats Forbes and Sir Edward Watkin, both of whom held several chairmanships at the zenith of their careers. Quite a number of general managers and other high officials have entered the service as lads in very humble capacities; and even the highest engineering posts have in former days been recruited from the lowest grades. But the tendency of the present day is to require a considerable amount of technical, as well as practical, knowledge from candidates for the leading positions in the various departments, and the avenues of promotion are not so free as they once were. Moreover, the number of high-salaried positions is proportionately very small. There are, for instance, only 110 principal officers employed by the London and North-Western Railway Company out of a total staff of nearly 83,000. Under such circumstances, whilst promotion to high rank and a big salary are possible to everyone who enters the railway service, they are, to say the least, improbable of attainment. For the vast majority railway employment means a steady and rather monotonous "grind," not at all magnificently remunerated; and not a few leave it to seek—but not always to find—their fortune in other spheres.

Undoubtedly one of the chief advantages of railway employment in the eyes of the higher grades of the staff is the certainty of a superannuation allowance on the attainment of sixty years of age, if retirement then becomes necessary. Each of the larger companies has its separate superannuation fund, under its own management, whilst the requirements of the officials of the smaller lines are met by the Railway Clearing House Superannuation Fund Corporation, which is open to the servants of any

A PASSENGER-GUARD, L. AND N. W. R.

A TICKET-EXAMINER, L. AND N. W. R.

CORRIDOR TRAIN ATTENDANT,
L. AND N. W. R.

railway affiliated to the Clearing House, as well as to the clerks employed at that institution. The North-Western Superannuation Fund, which may be taken as typical of these institutions, has a membership of about 9,000, who contribute 2½ per cent. on their salaries, the company subscribing the same amount per member. All the salaried staff under twenty-eight years of age are obliged to become members, and their contributions are deducted monthly on the pay-sheets. After ten years' membership a subscriber becomes entitled to a retiring allowance equal to 22¾ per cent. of his average salary, and this increases with the length of his membership, until after forty-five years of contributing he becomes entitled to 109 per cent., which is the maximum. Thus, if a person joins the fund at fifteen years of age, he becomes eligible for the maximum retiring allowance at the age of sixty. Many railway companies make retirement on superannuation compulsory at the age of sixty-five, unless a special exemption is granted by the Board. In cases of incapacitation through breakdown of health, the benefits of superannuation are obtainable at an earlier age. In the event of the death of a member before superannuation, his representatives receive either the equivalent of half a year's average salary, calculated over the whole term of his contributions, or the sum of his own contributions and those of the company on his behalf, whichever be the greater. Any member retiring from the service of his own accord before superannuation, or whose engagement is terminated by the company from any cause other than fraud or dishonesty, receives back the whole of his contributions to the fund ; but if he be dismissed for dishonesty, he may forfeit the whole. There is also a society for providing pensions for widows and orphans of members of the salaried staff.

For the benefit of the "wages staff," as distinct from the salaried servants, the London and North-Western Railway Company has a Provident and Pension Society and a Supplemental Pension Fund. Under the former, men become entitled to weekly pensions ranging from seven shillings to twelve shillings per week on retirement after the age of sixty-five, or after the age of sixty if disqualified for work, with half-pensions of three shillings and sixpence and five shillings per week if incapacitated under sixty after twenty years' service. Under the supplemental fund an additional pension of five shillings per week can be obtained. The society also provides allowance in case of disablement due to sickness or accident when not on duty ; an allowance at death of a member from other causes than accident on duty ; an allowance at death of a member's wife ; and a retiring gratuity, which, however, is being merged in the pension scheme. For these benefits the member's contribution is sixpence or sevenpence per week. This company has also an Insurance Society, the object of which is to provide an allowance for the first two weeks of disablement arising from accident incurred in discharge of duty, and other benefits supplemental to those obtainable under the Workmen's Compensation Act, 1897. Prior to the passing of this Act, the insurance society of the London and North-Western—and the similar institution connected with the London, Brighton and South Coast Railway—had a larger scope, and it may be remembered that many of the *employés* of these two companies wished to retain those societies as they were, and to "contract out" of the Act, but Parliament decided otherwise. The passing of the Act, it may be remarked, has largely increased the burdens upon railway companies' insurance and sick funds by encouraging "malingering," owing to the very generous allowances which accrue in cases of disablement. The London and North-Western has a separate pension fund for the foremen in its locomotive department. Several of the other companies are now taking steps to provide pension funds for the sections of their staffs who are in receipt of weekly wages, but, generally speaking, the security of a retiring allowance is limited to salaried servants—*i.e.*, the higher grade officials and clerks. The Great Eastern has largely established an Employees Sick and Orphan Society, the objects of which are to provide relief and medical attendance for members during sickness, and also payment of money on the death of a member or his wife, and to his orphan children under the age of fourteen years. In this connection, a reference should be made to the work of the Railway Benevolent Society, the object of which is to provide help in time of need for disabled railwaymen, and for the widows and orphans of those who fall in the service. This excellent institution fills up gaps in the provision made by the companies, who officially recognise its work and assist its operations in every possible way. Its offices are at 133, Seymour Street, Euston Square, London, N.W.

An advantage enjoyed by many railway *employés* is the institution of savings banks in connection with the companies. The London and North-Western Railway Savings Bank, for example, which was founded on January 1st, 1895, gives interest at the rate of three-and-a-half per cent. per annum on sums up to £500, and two-and-a-half per cent. on sums over that amount, and deposits of one shilling and multiples thereof are received, not more than £50 being receivable upon a single account in any one year. The railway company is entirely responsible for all deposits, for the interest thereon, and for the cost of carrying on the bank. These institutions form a strong inducement to thrift amongst the *employés* of the companies which have established them.

On account of the great variety of the duties which fall to the lot of railway *employés*, any standardised course of training for all who enter the service is, of course, out of the question. There is a choice of many doors of entry into railway work, and the nature of apprenticeship served differs widely. In the workshops, the word apprenticeship is applicable in its usual meaning to the lads who learn to become skilled mechanics and craftsmen in the service of the companies; and in this department every care is taken to give the aspirant opportunity for theoretical as well as practical education, attendance at classes at the nearest technical college being practically made compulsory upon lads working in the shops. In the traffic department, the training necessary to make a man a skilled workman has mainly to be picked up during the course of a steady progress through the various grades. It is scarcely necessary to say that engine-drivers are very carefully trained before being entrusted with the charge of a locomotive. They usually commence service as lads in the engine-sheds, where they are employed as cleaners; after a time they are promoted to be firemen; then to be drivers of goods trains; next to be drivers of slow or local passenger trains, and ultimately the most experienced and intelligent men are selected to drive the "crack" expresses.

The most scrupulous attention is paid to the training of signalmen, on account of the difficult and highly responsible nature of their employment. The period of probation differs according to the importance of the posts to which they are assigned, but no appointment of a man to the charge of a cabin is confirmed until the district superintendent has certified the candidate to possess every needful qualification, including freedom from colour-blindness, which is a fatal defect in an aspirant for promotion in the operating department of a railway. The guards of passenger trains are usually chosen from the ranks of porters, and the goods guards, or brakesmen, from amongst shunters, banksmen, and men of that class; but all these men are subjected to careful examination before their appointment to the trains, due regard being had not only to their knowledge and experience, but to their general intelligence, capacity, and character.

Every railway company has a manual of "Rules and Regulations to be observed by all persons in the Service," which takes the form of a handy volume of some hundreds of pages, carefully revised from time to time. A copy of this manual is supplied to every station-master, inspector, engine-driver, fireman, guard, brakesman, signalman, policeman, ganger, foreman, shunter, yardman, and gateman, and also to every clerk and porter connected with the working of the railway, and he is required to have it with him when on duty and produce it when required. He must also, of course, make himself thoroughly acquainted with the contents, as he is held responsible for compliance therewith, and in case of accident or other mishap, ignorance or neglect of any rule contained in the book entails serious consequences upon the servant at fault. It must be admitted, however, that the task of mastering the contents of the rule-book is not easy, as the regulations have necessarily to be framed to suit all conceivable combinations of circumstances. To meet this difficulty, the Great Western Railway Company has recently established classes at all important centres for the study of railway working arrangements, the rule-book being adopted as the text-book for the students, and the instructors being chosen from amongst the officials of the company who are

MODEL USED IN SIGNALLING SCHOOL, G. W. R.

best acquainted with the details of railway operation. At the termination of each course, an examination is held, and certificates are awarded to successful students. The equipment of the classes includes a model of a miniature double-line junction, with signal-box, signals, points, sidings, rolling-stock, and all other apparatus in full working order, and constructed in accordance with the company's latest standards, so that actual demonstrations can be given of the conditions provided for in the rule-book.

Candidates for railway clerkships have to undergo an entrance examination in writing, spelling, arithmetic, etc., the usual age for entering the service by this door being about fifteen—*i.e.*, immediately after leaving school. Of late years the problem of giving opportunities to railway clerks to acquire knowledge of the theory of railway management, in addition to what they can pick up daily in the offices, has received a good deal of attention. In London, lectures have been arranged in connection with the London School of Economics; in Manchester, under the auspices of the Faculty of Commerce of the Victoria University; and at Dublin, in connection with the Rathmines School of Commerce; whilst at Cardiff, York, and other centres, lecture and discussion societies have been formed amongst the clerks themselves, without affiliation to any teaching body. The directors of the various companies are doing all they can to encourage this healthy movement, the further development of which is very necessary if the avenue is to be kept open by which in the past many railway clerks have risen to high positions in the more technical and responsible grades of the service.

In addition to the various courses of training already mentioned, most railway *employés* who care to do so can obtain instruction in "first aid" and ambulance work at one or other of the numerous "centres" of the St. John Ambulance Association, which the directors of the companies have assisted that organisation to establish throughout the kingdom. The Great Eastern, for example, has no less than forty such centres on its system, and during 1904, 393 men presented themselves for examination for certificates of proficiency, of which number 360 satisfied the examiners. Competitions between ambulance teams representing various centres are organised by most of the companies, in conjunction with the Chapter of the Order of St. John of Jerusalem, and every year an inter-railway competition is held, the first prize in which is a very handsome shield, presented by the King (when Prince of Wales) and the Chapter, in celebration of the longest reign in English history. Eight of these yearly contests have been held up to the time of writing, and on no less than four occasions the team representing the Great Eastern Railway has carried off the trophy.

In many cases, as is well known, railway servants are provided with their working clothes. The number of complete uniforms supplied by the

London and North-Western Company in a year is about 15,000, which number does not include those grades which are only partially supplied with uniform clothing. The uniforms of railway policemen, it may be stated, do not imply any connection with the regular constabulary, and the wearers thereof have no jurisdiction off the premises of the companies they serve.

The payment of their wages to the *employés* of a great railway company is naturally a difficult business, necessitating great care and systematic checking. The principle most carefully observed is that the clerks who compile the wages bills and abstracts shall have no connection with the pay-clerks who handle the money. In some of the large workshops mechanical timekeepers are used, by means of which the men themselves, as they enter and leave the works, register the time for which they are entitled to be paid. The average amount paid weekly in wages over the North-Western system is about £87,000. The salaried staff of this company is paid monthly; of some others, fortnightly.

Whilst, as above stated, railway employment has the great attraction of permanency and security of pay, it also has, so far as the operating staff is concerned, a serious drawback—risk of accident. It is fair to the authorities to say, however, that more than half of the accidents which occur on railways are found by the Board of Trade inspecting officers to be due to want of common care and caution on the part of the sufferers therefrom. Nor is railway employment by any means the most dangerous occupation carried on amongst us. The percentage of fatal accidents amongst miners and quarrymen is considerably higher than amongst railway servants, and the risks incurred by seamen are estimated to be nearly nine times greater than those of railway *employés*.

The various subordinate divisions of the outdoor staff of a great railway are nearly all well known to the travelling public, but in how many minds will the name " number-taker " call up any responsive image ? Yet by an effort of memory most frequent travellers can probably evoke a vision of an official —somewhat more clerkly in appearance than the ordinary members of the " uniform " staff—whom they have casually noticed on the platform at some junction station, apparently engaged with pencil and note-book in making an inventory of the vehicles passing through. This obscure individual is one of a body numbering over 500, and they form the humble basis of the " Railway Clearing House " system. To apportion fairly and accurately amongst the companies the receipts and expenses on all traffic passing over more than one company's line, it is necessary to post an officer at every junction station or siding, whose duty it is to take note of all carriages, wagons, and " sheets " (or tarpaulins) passing from the lines of one company on to those of another. At all hours of the day and night and in all conditions of weather —rain and snow, fog and sunshine, storms and frost— the number-taker must be at his post. From a single

A GROUP OF OFFICERS, L. AND N. W. R.

This photograph was taken on the occasion of the departure from Euston of the delegates appointed by the Company to attend the International Railway Congress at Washington, May, 1905.

AMBULANCE TEAM, MARCH (CAMBS.), G. E. R.

Winners in 1903 and 1904 of the Inter-Railway Challenge Shield competed for by teams representing the principal railways of the United Kingdom, and of the Challenge Cup presented by the Directors of the Great Eastern.

Photo by Bertolle, March.]

goods train of forty vehicles he has to take down over 300 figures, denoting the numbers of the vehicles, together with such facts about them as the names of their owners—if they belong to a railway company —the name of the guard, the time of arrival and departure of the train, whence it came, whither it was destined, and the descriptions of the vehicles—that is to say, whether ordinary open trucks, or "box" wagons, whether constructed to carry loads of unusual weight, such as fifteen tons or upwards, or whether containing any explosive goods. In the case of passenger stock, the class or special description of the carriages must be noted, in addition to the numbers.

Having noted these required particulars, the number-taker goes to his office and copies out in due order, in separate columns and under prearranged headings, the information which he has collected. These "abstracts" are forwarded each week to the Railway Clearing House — a forbidding block of buildings situated in Seymour Street, London, at the rear of Euston Station. The four hundred clerks in the Mileage Department of the Clearing House sort and "post" these abstracts which come in from over 500 junction stations, their number exceeding three-quarters of a million in a year, exclusive of "nil" returns. The work of dealing with these returns commences with entering under the names of the several companies owning the vehicles the distinguishing numbers of those found away from their owner's lines. The destination of each vehicle is then noted, and it is traced through the intervening junctions to see what route it has followed. The information received from the number-takers as to the date of its ultimate arrival, and the date when it first left the owning company's lines, enables the Clearing House officials to determine whether due diligence has been employed, or whether the vehicle has been detained on a "foreign" line beyond the limit of time at the expiration of which a charge for "demurrage" has to be made. When the precise route over which the wagon or carriage passed has been ascertained, a reference to the distance-book enables the Clearing House clerk to calculate exactly what credit or debit has to be entered against each company over whose lines the traffic has been carried. This distance-book of the Railway Clearing House is a work in ten volumes, and contains the actual measured distances—supplied by the engineers' departments of the various companies—between some 17,000 stations, sidings, collieries, etc., and the various junctions on the railway system. From the measurements therein laid down there is no appeal.

This is the system by which accounts are kept between the companies, through the medium of the Railway Clearing House, as to the employment of each others' rolling stock for the purposes of through traffic. The apportionment of the actual receipts on goods or passengers passing over more than one company's line does not involve the employment of any outdoor staff by the Clearing House. But a very large number of clerks have to be employed to deal with the abstracts which are sent in monthly from every forwarding and receiving station, forming a summary of all through traffic sent or received. The abstracts include the names of the owners and numbers of the wagons, descriptions of the goods sent, whether they are "carted," "non-carted," or "mineral," and the amounts "paid" or "to pay." The returns sent in respectively by the forwarding and receiving stations have to be checked one against the other, and any discrepancy settled. Then, before the amount is agreed on for apportionment by mileage amongst the companies, there are a number of deductions and allowances to be made, such as amounts paid out by the forwarding company for pier dues, port charges, or to a road carrier, or extra tolls allowed on traffic passing over specially expensive sections of railway, such as the Severn Tunnel, the Forth Bridge, or some of the London lines. Then the amounts agreed upon between the companies for "terminals" have to be deducted and credited to the companies whose station premises were used. Even after all this, there often still remain troublesome questions to be settled as to compensation claims for loss, damage, or detention of the goods.

The through passenger receipts are "cleared" in a similar way by means of monthly returns sent in to the Clearing House from every station, giving the numbers of all tickets issued to passengers booked through to other companies' lines—that is to say, the progressive numbers printed on the first and last of the various series of tickets. On the information thus supplied, the Clearing House has to trace the route of the passengers, follow them to their destination, note how many and what lines they have passed over, and allocate to each of the companies that portion of the total sum to which it is entitled, whether by mileage or by special agreement.

The utility of the Railway Clearing House as a consolidator of the work of the hundred or more operating organisations between which our railway system is divided is still further enhanced by the various officers' "conferences" which have grown up under its auspices, and usually meet under its roof. There is a general managers' conference, a chief goods managers' conference, and a superintendents' conference, each of which holds regular meetings at which matters of joint working which require concerted action by the companies are discussed, and points of difference decided. The co-operation thus secured, however, is purely voluntary, and it does not prevent the companies from competing one against another in a variety of ways. Some attempt has been made of late to secure more complete railway co-operation throughout the kingdom through the medium of the Railway Association, an organisation with offices at Westminster to which forty-three of the companies are affiliated. To a certain extent a common defensive policy, particularly in connection with legislative attacks upon the railway

L. AND N. W. R. TRAIN RUNNING BETWEEN LONDON AND CARLISLE (300 MILES) WITHOUT A STOP, JUNE 19TH, 1903. A WORLD'S RECORD.

THE BOARD ROOM OF THE RAILWAY CLEARING HOUSE, LONDON.

Photo by Denton & Co., Union Road, Clapham.]

interest, has been evolved by means of this Association; but in matters relating to the services they perform, the interests of the different railway companies are so diverse that it is remarkably difficult to induce them to cohere for any other purposes than the handling of through traffic or the repulse of a common enemy.

CHAPTER III.

The Laying Down of the Lines.

"TRAFFIC, like water, will find its own level; it will go by the shortest route," was the dictum of Edmund Denison, one of the "fathers" of our railway systems. There is also a well-known saying that "an engineer can do anything, if he be only given money enough." These two axioms, read together, form the answer to the question: "On what principles have the railway lines of the United Kingdom been laid out?" The Government did not prescribe any plan, as in the case of France and some other of the Continental countries. The lines grew up piecemeal, as we saw in our first chapter, first as local railways and then as "systems" formed by the amalgamation of a number of adjacent companies. From this process of development roundabout routes at first resulted; but then the tendency of traffic to find its own level asserted itself, and for the through long-distance traffic the most direct lines possible had to be laid. Thanks to the wealth of our country and the immense and continuously growing volume of its internal traffic, our railway engineers have never been very seriously hampered by lack of funds.

THE EXCAVATION OF A NEW LINE OF RAILWAY IS COMMENCED AND PROCEEDED WITH IN SUCH A WAY THAT A TEMPORARY LINE CAN BE LAID DOWN AS EARLY AS POSSIBLE. ON NEARLY ALL JOBS IT IS CUSTOMARY TO BRING A "STEAM NAVVY" ON TO THE WORKS.

AT THE COMMENCEMENT, HORSES PULLING "TIP-WAGONS" ARE WORKED BETWEEN THE FACE OF THE EXCAVATION AND THE "TIP-HEAD" WHERE AN EMBANKMENT IS BEING FORMED.

We have been able to afford to have not only one, but several, railways between all our great centres of population; and our trunk lines, as a whole, have been laid out almost regardless of initial expense. The service given to the rural districts is not so satisfactory; but only in Ireland and the Highlands of Scotland has it been found necessary for the State to help to fill in gaps left by private enterprise.

London—the traffic centre of the whole kingdom—has no less than ten main systems of railway radiating from it. This number is exclusive of the eight local lines of the Metropolis—the Metropolitan, Metropolitan District, North London, East London, Central London, City and South London, Waterloo and City, and Great Northern and City, a group to which several new lines are now being added. A recent return showed that there were 255 railway passenger stations within six miles of St. Paul's, and 391 within twelve miles, and these numbers have since been considerably added to by the opening of the "tube" lines and by the growth of the suburbs. The Great Eastern Railway Company alone has about eighty passenger stations within the twelve-mile radius, the Brighton Company coming next with about fifty. Many of the stations in London are used by the trains of more than one company, and if each station be given credit for each company whose trains run into it, the total is probably not less than 700 for the 453 square miles which lie within the twelve mile radius of Charing Cross.

The main stream of British traffic flows between the Metropolis and the manufacturing and colliery districts and the ports of the northern parts of the kingdom. The pioneers of our railway system thought that one trunk line with branches would be sufficient to hold that stream, and the London and Birmingham, with its two continuations—the Grand Junction, running north-westwards to Manchester and Liverpool, and the North Midland, running north-eastwards to York—were laid out by George Stephenson as a complete railway system for the central and northern parts of England. At the present time there are five trunk lines connecting London and the north by routes each of which can claim to be fairly direct —the London and North-Western, Great Central, Midland, Great Northern, and Great Eastern, whilst the Great Western also reaches Lancashire. Three of these six—the London and North-Western, Midland, and Great Northern—are continued into Scotland by the lines of allied companies. The North-Western and Caledonian compose the "West Coast route" between London and Scotland; the Great Northern, North-Eastern, and North British form the "East Coast route"; whilst the Midland is in alliance with both the North British and the Glasgow and South-Western, the former making its connection with Edinburgh and beyond—known as the "Waverley route"—and the latter carrying its Glasgow traffic. The traffic between London and Ireland is conveyed chiefly by the London and North-Western, *viâ* Holyhead, but both the Great Western and the Midland have new routes in process of development—the former *viâ* Fishguard, in Pembrokeshire, and Rosslare, and the latter *viâ* Heysham (Lancashire) and Belfast (opened in September, 1904). There is also a joint North-Western and Lancashire and Yorkshire route *viâ* Fleetwood, and a joint North-Western and Midland route *viâ* Stranraer and Larne. The last-named gives the shortest open-sea passage.

An important stream of English traffic runs between Lancashire and the ports of the East Coast. This is conveyed chiefly by the Lancashire and Yorkshire, and Great Central railways, the latter having been known until recently as the "Manchester, Sheffield, and Lincolnshire." Its modern name, "Great Central," dates from the opening of its extension to London in 1899. The Hull, Barnsley, and West Riding, and the Lancashire, Derbyshire, and East Coast are also lines running across England, east and west. The last-named has a much larger title than its actually completed undertaking warrants, Chesterfield and Sheffield on the west, and Lincoln on the east, being the termini of its constructed lines.

Of all the railways of the United Kingdom, the Midland is the most nearly ubiquitous. Its lines—wholly or jointly owned—extend from Swansea on the west to Lowestoft on the east, and from near Bournemouth in the south to Stranraer and the Forth Bridge in the north. Its latest enterprise has been to acquire several hundreds of miles of railway in the North of Ireland. The North-Western's system is also very widespread, as it reaches Carlisle and Stranraer in the north, Cambridge on the east, and

Carmarthen and Holyhead on the west, besides including a short mileage around Greenore in Ireland. In marked contrast to these ubiquitous systems is that of the North-Eastern—as large as the Midland's in point of mileage, but absolutely confined to the part of England indicated by its title. The North-Eastern enjoys the nearest approach to a monopoly of territory of any of our railway companies, and it is also the largest dock-owner amongst them. Its southern ally, the Great Northern, on the other hand, owns no docks, and is the line which is, perhaps, most of all exposed to the forces of competition by land and water.

The inferiority, in some respects, of the lines south of the Thames arises from the comparative poverty of their traffic field. Unlike the northern railways, the southern companies have to depend mainly for their revenue on passenger traffic. The South-Eastern and London, Chatham, and Dover have, since 1899, been managed by a Joint Committee, and the energies which their authorities used to waste upon incursions into one another's territory are now concentrated upon the improvement of the combined undertaking. The main stream of their traffic, and also of that of the London, Brighton, and South Coast, and London and South-Western, is between the Metropolis and the sea. All three work steamboat services in connection with the railways of France, whilst the Great Eastern, Lancashire and Yorkshire, and Great Central compete for the Continental traffic *viâ* Holland and

THE TRAIN IS EMPTIED WAGON BY WAGON BY A "TIP-HORSE."

LATER ON, LOCOMOTIVES ARE BROUGHT UPON THE SCENE. WHERE THE "MUCK" (EXCAVATED MATERIAL) HAS TO BE HAULED FOR SEVERAL MILES, THE TRAIN OF EMPTIES IS TAKEN BACK TO THE CUTTING, AND A THIRD TRAIN, WHICH HAS BEEN FILLED IN THE MEANTIME, IS THEN READY TO BE DESPATCHED.

Denmark. The South-Western benefits largely from the volume of trans-Atlantic traffic flowing through the port of Southampton. Should Dover also rise into prominence as a trans-Atlantic port—as seems not unlikely in the near future—the South-Eastern may become as prosperous a railway company as the South-Western, the ordinary stock of which has for some years past averaged a higher price than that of any other English railway company. In the west, the South-Western is a keen competitor with the Great Western at several important points, and recently an attempt was made to extend the supposed benefits of this rivalry to Bristol. The South-Western authorities, however, withheld their support from the project, which was consequently rejected by Parliament.

With the exception of the North-Eastern, none of the larger English railways have clearly defined territories exclusively their own. Most of them, however, monopolise one or more valuable streams of traffic, and numerous agreements and understandings exist between the companies by which invasions of each other's "kingdoms" are kept in check. This system of territorial division by agreement is very strongly enforced in Scotland. There are also numerous arrangements between the companies for "pooling" competitive traffic—*i.e.*, placing the united receipts into a common purse, and dividing them into prearranged percentages for each route. All rates and fares between competitive points, too, are agreed between the companies concerned. Notwithstanding all this, however, there is the keenest competition in "facilities," and canvassing and advertising are lavishly employed by every company in order to attract traffic to its own, and divert it from a competitive line. Whilst charters for new competitive lines have frequently been refused by Parliament, the attitude of the Legislature, generally, has been to encourage the companies to rely for financial success less on territorial monopoly than on unceasing exertions to improve their services, and in that way to win, safeguard, and increase their traffic.

"Esteemed friend, George Stephenson," wrote Edward Pease, when sending him his first instructions with regard to the Stockton and Darlington Railway, "in making thy survey, it must be borne in mind that this is for a great public way—its construction must be solid." Practically every engineer who has laid out railways in this country has received, and acted upon, similar instructions. Professor Hadley, of Yale University, says in his well-known work, "Railroad Transportation": "The feature of the English railroad system which most forcibly strikes an American observer is its stability. This is the fundamental difference between their railways and ours. It shows itself in their construction, their management, and their legal relations. The mere traveller sees it in the massive stone bridges, the tunnels and viaducts, the station accommodations, and a thousand details of less importance which combine to produce an impression of solidity and finish entirely wanting in the majority of American railroads."

The "standard gauge" of British railways—*i.e.* the width of 4 ft. 8½ in. between the two rails—was not adopted for any scientific reasons. It happened to be the width between the wheels of the trucks used at the collieries on the Stockton and Darlington line. When the plans for another of the earliest lines—the Leicester and Swannington—were under discussion, someone suggested that 3 ft. might be a better gauge than 4 ft. 8½ in. "This won't do," George Stephenson is reported to have exclaimed. "I tell you the Stockton and Darlington, the Liverpool and Manchester, the Canterbury and Whitstable, and the Leicester and Swannington must all be 4 ft. 8½ in. Make them of the same width; though they may be a long way apart now, depend upon it, they will be joined together some day." Brunel, who was a much more scientific engineer than Stephenson, adopted a much broader gauge—7 ft.—for the Great Western Railway, because he thought that width necessary to obtain the low centre of gravity in his engines, which, with large driving-wheels, he considered essential to safety and smoothness in fast running. Modern practice, however, has shown that engines with a high centre of gravity run smoothly and safely.

Another reason for the introduction of the costly 7-ft. gauge was the theory—also now proved to be erroneous—that a wide rail gauge was necessary to support a commodious carriage body. Experience has proved that anything in reason as to size and shape of vehicle is possible on our standard rail gauge of 4 ft. 8½ in., provided there be sufficient latitude and altitude in the "loading gauges"—*i.e.*, the restrictions placed upon the width and height of the vehicles by the positions of the permanent structures abutting upon the running road. Unfortunately, when the main lines of our railway system were laid out, the capabilities of the standard gauge in regard to carrying wide and high vehicles with safety were seriously underrated, nor were any uniform loading gauges agreed upon—an omission which has robbed our hardly won uniformity of running gauge of a good deal of its value. Moreover, unnecessarily high platforms were adopted, which have added materially to the cost of the lines, besides restricting the width of the vehicles. Increased width of rolling-stock means increased earning capacity, and for many years to come our railway companies will have to face the expense of gradually increasing their load gauges. A beginning in this direction has lately been made in connection with the electrification of some of the lines in the north of England, where some slight alterations in the permanent structures, together with the abolition of side-doors, have permitted the running of passenger carriages 10 ft. wide. In the ordinary way, however, the width of our passenger carriages has to be restricted to 9 ft., and of our goods stock to 8 ft., although our running gauge is capable of carrying vehicles of considerably greater width.

THE TEMPORARY ROAD, BEING USUALLY LAID WITH AS MUCH SPEED AS POSSIBLE, AFFORDS VERY ROUGH TRAVELLING.

Photo by Blomfield & Co., Hastings.

TUNNELLING IS A SPECIALLY DIFFICULT BRANCH OF RAILWAY CONSTRUCTION. THE EVENT OF THE FIRST RUN BY A CONTRACTOR'S TRAIN FROM END TO END IS ALWAYS ONE OF MUTUAL CONGRATULATIONS.

Another misconception generally entertained when the outlines of our railway system were laid down, has had consequences of an opposite kind. This was the notion that the locomotive could not climb hills, and that therefore all main lines of railway must be made practically level, the only alternative being to work the traffic over a hill by a stationary engine. Experience has amply demonstrated the hill-climbing capacity of the locomotive, but modern engines have not increased in power faster than modern trains have increased in weight. Such few inclines as exist on main lines in Great Britain—the Lickey (2 miles of 1 in 37) on the Midland, near Bromsgrove, for example, or the Cowlairs Tunnel incline on the North British, near Glasgow (1 mile 450 yards of 1 in 45)—are a source of considerable extra expense and inconvenience to the companies which have to work them, and it is highly probable that it would have been cheaper to have constructed such lines differently, so as to obtain a more level run. As a rule, however, no expense was spared in getting easy grades for our principal lines of railway when they were first laid down, and this has saved the companies from the serious liability of having to "regrade" for the sake of economy in working—an experience common in the case of American railroads.

Whether any more trunk lines of railway will need to be laid down in the United Kingdom is an open question; but anyone with a general acquaintance with the country can point to gaps here and there which it would be desirable to fill up by the construction of new branch lines. Such schemes may be talked of in a district for years before they take practical shape through the energy of some land-owner, solicitor, estate agent, or peripatetic engineer. When a representative of each of these classes becomes keen on a new railway project, there is a good chance of things making a move. For many years past Parliament has made intermittent efforts to make the path smoother for promoters of local lines, and the Light Railway Commission, alluded to in the first chapter of this volume, was instituted about five years ago, mainly with that end in view. This tribunal holds local inquiries in places of investigation by Parliamentary Committee, and in various other ways reduces the expensive formalities of ordinary railway promotion. But in cases where the proposed new line is likely to compete for traffic with an established railway, the Light Railway Commissioners are bound to refer the scheme to the adjudication of Parliament.

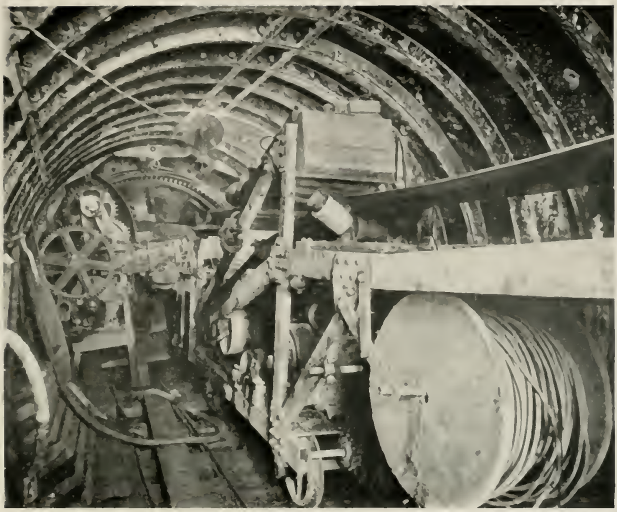
Application to Parliament means the promotion of a Private Bill, the expense of which is sure, under the most favourable circumstances, to run into thousands of pounds. A certain substantial amount of financial backing has therefore to be assured, to cover promotion expenses; and of late years a strong disposition has been shown by Parliamentary Committees to require a good deal more than this, promising schemes having been rejected simply because the promoters could not say definitely whence the money needed for the making of the line would ultimately come. In the days when Committees were less exacting, solicitors and engineers were wont to go for Parliamentary powers for new railways "on spec." The Act, once obtained, was regarded as an asset which, if it were not carried into effect, could at least be marketed for something over the promotion expenses—the purchaser in nine cases out of ten being an established railway company, who bought the line either because they wanted it made or because they didn't—very often the latter. In that case it was comparatively easy for the company who had purchased the Act to obtain leave to abandon it in a future Session.

November 30th is the last day for depositing documents at the Private Bill Office of the House of Commons. All arrangements for doing so are put in the hands of a "Parliamentary agent," who thoroughly understands all the technicalities of procedure, and is responsible for the wording of the Bill. The book of reference, which gives the names of the occupiers, owners, and lessees, as well as a description of all property through which the projected railway passes, is usually prepared by the solicitor. The plan and section and estimate of cost is the work of the engineer. All local authorities are entitled to a copy of that part of the documents which affects their district, and notices also have to be inserted in the advertisement columns of newspapers circulating in the affected parts.

The details of the scheme now being public property, the opponents of the Bill prepare their objections in the form of petitions to Parliament, which have to be lodged by January 15th. If the promoters of the Bill satisfy, as they usually do, the examiners that "Standing Orders" (which describe the rules and regulations of Private Bill procedure) have been complied with, the Bill is then classified and duly comes for hearing before one of the Parliamentary Committees already described. Both sides have to be represented by counsel, and the fees earned by some of the leaders of the Parliamentary Bar are enormous. It is not unusual for a well-known K.C. to earn considerably over £1,000 in a single week during a busy Session. The work, however, is often of a very trying nature.

In the House of Commons, a Committee gives its approval to a Bill by "declaring the preamble proved." In the House of Lords, the formula is: "The Bill has leave to proceed." The three readings in each House are usually pure formalities, but occasionally an M.P. moves the rejection of a railway Bill before the full House, and this is even done sometimes after a Committee has heard the whole case and approved the measure. Then the chairman of the Committee becomes the champion of the Bill against the obstructionist, and almost invariably the decision of the tribunal is upheld.

Having obtained their Act, the promoters have as their next task the raising of the capital to make the line. The release of the cash deposit required by Parliament as a proof of *bona-fides* goes but a little way, and if the money market be favourable,



THE "SHIELD" HAS BEEN LARGELY EMPLOYED IN THE CONSTRUCTION OF "TUBE" RAILWAYS. SEVERAL IMPROVEMENTS AND ADDITIONS HAVE BEEN MADE SINCE ITS FIRST ADOPTION. THE LATEST IS THE INVENTION COMMONLY SPOKEN OF AS A "DIGGER."

WITH "CUT AND COVER" THE WORK IS DONE FROM THE TOP. FINALLY THE REMAINING EARTH, VULGARLY CALLED THE "DUMPLING," IS REMOVED.

the issue of a public prospectus is often resorted to. Should the public "come in," well and good; otherwise there is some strain upon the resources of the private backers, and not infrequently the whole scheme comes to shipwreck on the rock of finance. The timely assistance of a big railway company will sometimes save the project, or the more equivocal support of a big firm of contractors, who happen, perhaps, to have plant idle, and offer to construct the line for "paper"—*i.e.*, to take shares instead of cash as payment for the whole or part of their work. Sometimes a contractor has been "in" the scheme right from the beginning, helping with the promotion expenses on the understanding that he will be rewarded by receiving the contract when the time comes. In such cases the price paid for the work naturally rules higher than when the engineer is in the independent position of being able to call in tenders from various firms, from which the directors, by his advice, choose the one whose figures are the most satisfactory.

Meantime the solicitor and the land agent have been busy with the often very troublesome negotiations and formalities involved in obtaining possession of the land required for the line. Although the Act gives compulsory powers of purchase, terms have to be arranged and title-deeds transferred. The most troublesome of the landowners will probably have already been encountered during the Parliamentary campaign; and if their opposition to the line has been of a determined sort, they have probably had to be bought off with a clause in their favour specially inserted in the Act, or by the promise of a "fancy" payment for the alleged disturbance of the amenities of their properties. In nine cases out of ten, a landowner stands to gain more than he loses by the making of a line through his estate; but the hope of compensation greatly stimulates his vision of inevitable damage, whilst the prospective advantages of improved communication—unless he be one of the promoters of the line—are carefully kept in the background of his mind. One of the most eminent of railway solicitors—himself an adept at a bargain—has testified that the acuteness exhibited by the landed gentry as to the means of wringing money from a railway company went beyond anything which he or any other individual could have conceived. This acuteness is reflected in the heavy capitalisation of the companies, and it needs to be borne in mind in comparing the cost of our lines with those of other parts of the world, where the land required for railway construction has often been obtained for nothing. Nor have our railway companies—with one or two exceptions in London—been permitted to make profit by selling their surplus lands—a proceeding which has been a source of much gain to railway-makers in other climes. The Royal Commission on London Traffic has recently recommended that railway companies making lines into undeveloped suburbs should be allowed to embark upon land speculation with a view of recouping themselves for their outlay from the enhanced value of the property served by the line, a remunerative traffic in such cases being of slow and doubtful growth.

Until the purchase of the land is quite complete, the contractor proceeds with the work of constructing the line under conditions of peril. It is difficult for his agent to obtain a complete knowledge of the boundaries of the various estates; and should his men commence work on land the conveyance of which has not been duly carried out, he may find himself the victim of proceedings in the Court of Chancery, from which he will emerge a wiser but a poorer man. When it is desired to produce a good impression in the neighbourhood, and the promoters are of a convivial temperament, the cutting of the first sod may be made the occasion of a ceremony at which the wife of some local magnate will perform the feat with a silver spade presented to her by the contractor, and a company will afterwards be entertained to luncheon. More often there is nothing done to mark the day when the contractor sets his men to work, and the first turf is hacked up unhonoured and unsung.

Prior to this, the engineer—who is usually a London man—will have sent down a staff to the scene of operations, under the command of one of his chief assistants, who is briefly known as the "resident." For this official the contractor erects an office on the line of route, usually next door to that put up for his own representative or "agent." The agent has under him an engineer (who sets out the work and takes the levels), timekeepers, and walking gangers. The timekeepers have to be up early of a morning and visit each gang of men; and during the course of the day they go their rounds again. For this purpose the work is divided into sections, so that there may be no overlapping. The question of how often a navvy may have a "sub"—*i.e.*, draw a portion of the money due to him—is one which is usually settled by the exigencies of the job. Sometimes "subs" are given once a week, or maybe twice, though it often happens that eventually they are doled out every day to those who demand them. The duties of a walking ganger consist in traversing his section to and fro, noting the daily progress of each gang, promptly dealing with any little difficulties which arise, and generally ensuring the working without hitch. For this office a man needs to be tactful, broad-minded, and able to hold his own against any nonsense.

Occasionally the contractor sublets the excavation of a small cutting to a ganger, who then pays the men under him out of his own pocket; or a number of navvies undertake to do some excavation, in which case they elect a headman from among them. In such instances the work is said to be done by a "butty gang." If the work is carried out, well and good; but in the event of any shortage of cash on the part of the ganger, or dispute amongst the men, the contractor has to make other arrangements to finish the work. If, however, no difficulties arise, a good deal of time is saved through the men having the incentive to work their hardest.

OFTEN IN CROSSING A NAVIGABLE RIVER A RAILWAY BRIDGE IS CONSTRUCTED WITH A SWING SPAN, WHICH IS USUALLY WORKED BY HYDRAULIC MACHINERY.

BRIDGE OVER BREYDON WATER, YARMOUTH, MID. AND G. N. JOINT RLYS.

The navvy may be roughly classified under two heads—the navvy proper and the tramp navvy. The former is a respectable member of the community, despite popular notions to the contrary; he enjoys good health and is a good companion. He travels all over the country and acquires a peculiar *savoir-faire* as a consequence. If he is industrious, steady, and has a certain ascendancy of manner, he usually becomes a ganger. It is a curious fact that a navvy who has been raised to take charge of a gang will, when it is broken up, resume his former place as a member of another gang without demur. The tramp navvy is a less desirable person, being a poor specimen, addicted to drink, not over-scrupulous in his ways, and more often than not in need of a thoroughly good soap-and-water bath, and disinfecting. Some of these individuals tramp the country, working in a gang for a day or so, perhaps even for a week; then live riotously for as many days as their wages last, and finding themselves again in a "stony-broke" state, move on to the nearest job and repeat the same demoralising tactics. So often are these men without any money that there is an unwritten law amongst them that if any out-of-work finds a former mate working in a gang, he may be absolutely certain of receiving a shilling to help him on his way, unless he is known to subsist in this way without ever doing any work. It is not unusual for a ganger who has worked under many contractors to disburse in this way several shillings in one day.

The word "navvy" is abbreviated from "navigator," and was first applied to designate men engaged in the construction of works for inland navigation. When canals gave place to railways, the name not unnaturally was used to denote the same class of men, whose employment was but little different under the new conditions. A "nipper" is the generic term given to any boy employed in the construction of a railway, in whatever capacity.

The excavation of a new line of railway is commenced and proceeded with in such a way that a temporary line can be laid down as early as possible. When it is impossible, owing to local conditions, to push this forward as quickly as is desired, an "overland route"—*i.e.*, a temporary line laid on the natural surface of the ground belonging to the railway company—is put down, so that materials and plant may be carried directly from the nearest station to their destination, and the contractor thus be saved the heavy expense of cartage by road. At the commencement, horses pulling "tip-wagons" or three-wheeled carts called "dobbins" are worked between the face of the excavation and the "tip-head" where an embankment is being formed; but as this distance increases, locomotives are brought upon the scene. Where the "muck" (excavated material) has to be hauled for several miles or more, the train is drawn by an engine to the "bank" and left there to be emptied, wagon by wagon, by a "tip-horse" or by a light engine, known as a "tipping engine," which is specially constructed for the purpose. While this process goes on, the train of empties is taken back to the cutting, and a third train, which has been filled in the meantime, is then ready to be despatched. Whenever possible, the cuttings and embankments are so planned as to "balance" one another—*i.e.*, the excavated material suffices to complete the banks.

On nearly all jobs it is customary to bring a "steam navvy" on to the works where a cutting of considerable size has to be excavated. These tearing leviathans can be operated by one man, and fill a wagon with two or three scoops, thereby saving much time. Not only do they handle many more times the amount of "muck" in one operation than their human namesakes, but also combine the actions of excavating and filling.

The lines which are laid down at first, while the roughest work is being done, belong to the contractor, and are afterwards replaced, when the embankments have settled and the cuttings been cleaned, by the "permanent way," which is put down on ballast. The temporary road, being usually laid with as much speed as possible, affords very rough travelling; the sleepers often become damaged and broken, and derailments are, consequently, not unknown.

The weight of the rail for the permanent way varies according to the nature of the traffic which it has to carry, and ranges between 75 lb. and 100 lb. per yard. The tendency nowadays, owing to the ever-increasing weight and speed of express trains, is to have the rail 100 lb. per yard on main lines, and 85 lb. on branches; otherwise, "maintenance" becomes an unduly heavy item in the company's accounts. A sleeper is usually 9 ft. long by 10 in. wide by 5 in. deep. The chair, which is bolted to the sleeper, and into which the rail is wedged by means of small wooden keys, averages in weight 45 lb. to 50 lb. The fishplates, which hold the rail-ends together, vary in size and weight.

Tunnelling is a specially difficult branch of railway construction, and the contractor aims at having, if possible, men who have been engaged on this class of work before, and who are called amongst their mates "miners." Great care has to be exercised throughout that the true centre line is not deviated from. The most common method of working is for the centre line to be set out on the surface of the ground over the hill through which the tunnel is to be driven. At certain points shafts are sunk to the level of the heading, and a steel wire, to the bottom of which is fastened a heavy plumb-bob, is suspended in a bucket of water at the bottom of the shaft. The engineers have thus an absolutely perpendicular straight line from the true centre line at the top, from which they work down below, and check their previous calculations from the mouth of the tunnel. The two "headings" should meet without any divergence, and an appreciable error in the centre line of one is unusual. At various points in the heading, "break-ups" are made—that is to say, the excavation is enlarged sufficiently for the brick linings to be put in, and they are then extended in each direction. The number of rings of brickwork

THE ERECTION OF A CABLEWAY IS OCCASIONALLY ADOPTED TO FACILITATE THE CONSTRUCTION OF A VIADUCT.

Photo by F. W. Shephard, Lyme Regis and Axminster.

WHERE A VIADUCT HAS TO BE BUILT, THE WORK IS PUSHED FORWARD

varies from four to eight, the greater number being used where the surrounding material is liable to swell or to fall in, or where much water is found. London clay is very bad to work in, and requires great thickness of arch. The heading is supported with timber struts, which sometimes give vent to most ominous-sounding cracks and groans, which the navvies refer to as "talking." Gases are a frequent source of danger; and a sure sign of their presence, when the odour is imperceptible, is given by the diminishing flame of a lighted candle. When it is impossible to strike a match, or when the lighted candle you are carrying quietly snuffs out from no apparent cause, then it is high time to "make tracks" for the fresh air. Tunnels frequently are very wet, owing either to fissures being cut into, or soakage through the roof and walls. To protect themselves, the miners wear thick flannel coats, called "donkeys," which are impervious to dripping water for some length of time. If, however, the leakage is very bad, the men resort to oilskins.

Old abandoned coal-workings are a frequent source of trouble in connection with tunnels. Their whereabouts are unknown, and consequently may remain undiscovered until a sudden break-away or settlement reveals the hidden danger. If much rock has to be removed, blasting is usually the method employed for dislodging it. The powder-box is placed in the charge of a thoroughly trustworthy man, who devotes his time to seeing that accidents are avoided from the powder going astray. In at least one case, however, the guardian of the box partook too freely at the public-house before coming on work, and was overcome by sleep on his arrival. Familiarity had apparently bred contempt, for he calmly lay down inside the well-filled box and, being somewhat timorous of absolute darkness, placed his lighted lantern by his side on the uncovered powder. Fortunately, he was discovered in time to be discharged —without any other explosion than one of wrath.

Underground railways in towns are constructed either by the method expressively known as "cut and cover," or by means of the "shield" invented by the late Mr. Greathead, the engineer of the City and South London Railway, which has been so largely employed in the construction of "tube" railways in London. In its original form the shield was an annular skin of steel, sufficiently large to envelop the circular iron lining of the tunnels, which is built up in segments inside it. It is sufficiently long to cover the last ring to be bolted up, and to project forward as far as is necessary to cover or "shield" the workmen who are picking at the solid face of clay in front. Several improvements and additions have been made since its first adoption. The latest is the invention of Mr. John Price, a well-known London contractor, to whom the idea occurred of fitting blades, set at an angle to the face of the clay, and causing them to revolve until the clay is pared off. These parings are caught in hoppers and carried thence on the endless rubber belt of a conveyor a distance of some fifteen feet or more back into the tunnel, where they are deposited into wagons. The wagons are then drawn by ponies to the foot of the shaft and taken up one by one to the surface in the lift. This tunnelling machine is commonly spoken of as a "digger."

The great advantage of the shield system over "cut and cover" is that with the former the surface of the ground is not disturbed. With "cut and cover" the work is done from the top by sinking two wide trenches in which the side walls are built up to about four feet high. Then the excavation is taken out full width down to that level, the centering fixed, and the arch turned. Finally, the remaining earth, vulgarly called the "dumpling," is removed.

The strata pierced by the tubes vary in different parts of London, but for the greater part of their length they are well down in the London clay. At some points, however, there appears to have been a geological upheaval, with the result that a less satisfactory stratum has to be pierced. Sometimes this proves to be water-bearing gravel, in which case the use of compressed air is resorted to, in order to keep out the water until the tunnel is complete. Such a step entails a good deal of extra expense, directly and indirectly. Air-locks have to be fitted, which takes time, and other plant has to be brought on to the site. Progress in driving the tunnels is necessarily much slower, the traffic between the working face of the tunnel and the bottom of the shaft being hindered by the time taken in passing through the air-lock, while shifts of miners are necessarily more frequent, owing to the limited period for which a man can safely endure the extraordinary atmospheric pressure. The illness resultant upon too long a stay in the air-chamber is usually of a most painful character. The pain, or, rather, agony—strong men have been known to implore their mates to kill them while under its influence—usually attacks its victim in one of his joints, such as the knee or wrist, and the sufferer experiences a sensation as from the incision of sharp razors. A doctor is kept on the works to attend immediately to all cases of sickness arising from this cause, the remedy being to put the patient back in an air-lock specially kept for this purpose. The fact that instant relief is thereupon experienced supports the theory that small globules of compressed air have made their way between the layers of the skin and expanded when the workmen returned to ordinary atmospheric pressure.

Compressed air has often to be resorted to in the construction of railway bridges over water, the best-known example being the sinking of the "caissons," or cylinders, which formed the foundations of the great Forth Bridge. This mighty structure is sufficiently high to clear all navigation, but often in crossing a navigable river a railway bridge is constructed with a swing span, which is usually worked by hydraulic machinery and interlocked with the signals at either end of the bridge.

The building of bridges over or under public thoroughfares is often a matter of some bother to

IF MUCH ROCK HAS TO BE REMOVED, BLASTING IS USUALLY THE METHOD EMPLOYED FOR DISLODGING IT.

Cutting on Keighley Branch, G.N.R. (in course of construction).

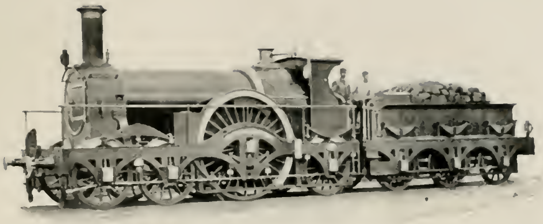
the agent, especially where traffic on the road must not be interrupted, even for one hour. It is usual to divert the road whenever possible, or else to build a temporary bridge alongside the site of the permanent one. In places where the foundations are bad owing to the presence of water in the ground, serious delay may occur to the works, owing to the necessity for bringing more men to the spot from another job, or the compulsory taking up of the temporary road to allow of additional foundations being put in. Though the erection of a bridge looks a very simple matter to the passer-by, probably he would be surprised if he were aware of the many details attendant upon its construction. The order in which it is to be built has to be carefully planned, so that the masons and bricklayers may not be overwhelmed with work at one time, and standing idle a few weeks afterwards.

Where a viaduct has to be built (provided that the ground is not waterlogged, or the foundations treacherous from other causes), less worry attaches to the construction than might be supposed. Usually the work is pushed forward with special energy, and commences as soon as the staff and plant are on the site. Of course, there is always the feeling that in the event of some bad settlement taking place, a large interest is at stake, and much extra expense will be necessary before it can be rectified; but, as compensation for this, there is the pleasure of seeing the structure gradually rising day by day.

The erection of a cableway, slung at each end from a mast, the travelling carrier of which is driven by a stationary engine on the ground, is occasionally adopted to facilitate the construction of a viaduct. When the line is straight, this has been found to prove an economical method of hoisting and transporting the materials and plant, especially during the early stages of the work, before the arches have been turned. It is not improbable that this method of handling the material in such places will be more widely used in the future, though the first cost is somewhat heavy.

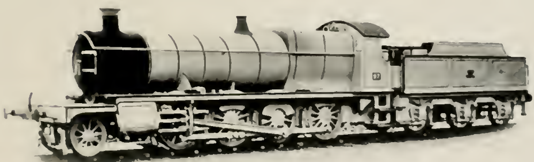
At length there comes a time when those on the works become conscious of the approaching maturity of their labours. The locomotives which have been running daily can now travel miles without coming to a break in the line, and the event of the first run by a contractor's train from end to end is always one of mutual congratulations between the two staffs. The resident makes copious notes of odds and ends which still have to be done, and these are handed on to the agent, who in turn probably pockets them and tries to forget them, while his men are engaged in pushing forward the completion of those more important works which must be done before the line can be opened. The stations and station buildings, which have hitherto been in an embryonic state, are now the scene of active operations: bricklayers, joiners, masons, all hard at work putting finishing touches. Telegraph-poles spring up all along the route of the railway. Signal-posts appear, to mark from afar the site of the stations; and wires run along, to trip the feet of the unwary. Meanwhile the engineer has obtained from the Board of Trade printed forms detailing the works of the line, which have to be filled in and forwarded to the secretary, with plans, to be examined by the Government inspector. The latter then arranges with the company's engineer the date of his visit, to travel over the line from end to end, stopping at all bridges and testing them, examining culverts, testing the signalling apparatus, and generally inspecting everything, so that he may be fully qualified to report to the Board of Trade authorities, whom he represents, whether, in his opinion, the line is ready to be opened to the public. A short period usually elapses between the inspector's visit and the opening, as minor requirements have to be effected before the necessary permission is given. In some cases where the embankments are still settling, or from other causes, the Board will sometimes sanction the opening of the line for goods traffic only at first, but it is fair to English engineers and contractors to say that this is the exception rather than the rule. The resident and agent have a busy time of it during the last few months, for all work has to be measured up and tabulated, so that the contractor may render his final statement, showing the amount still owing to him after the payments on his monthly certificates have been deducted.

The opening of a railway, like the cutting of the first sod, may or may not be attended with ceremonies of a public and convivial character. Representatives of the local newspapers usually consider themselves entitled to some attention on these occasions, as representing, and seeking favourably to impress, the wider public, upon whom the line will shortly have to depend for support. Whether or not there be a ceremonial opening, and the running of a "first train" filled with invited guests, the appreciative journalist is sure to be given an opportunity of making a survey of the works prior to the running of the public service. In the company of the resident or agent, or both, he receives careful instruction as to the engineering feats now successfully performed, difficulties or drawbacks being lightly passed over, and examples of courage and resource veiled behind the characteristic modesty of "the man who does." These men are the true makers of the modern world, though their names do not get into *Who's Who* or the personal columns of the newspapers.



"IRON DUKE"—OLD TYPE OF EXPRESS PASSENGER ENGINE, G. W. R.
Photo by Locomotive Pub. Co.

EXPRESS ENGINE, "ATLANTIC" TYPE, G. N. R.



"CONSOLIDATION" TYPE OF GOODS ENGINE, G. W. R.
Photo by Locomotive Pub. Co.

MINERAL ENGINE, WITH PORTRAITS OF MESSRS. IVATT AND STURROCK,

CHAPTER IV.

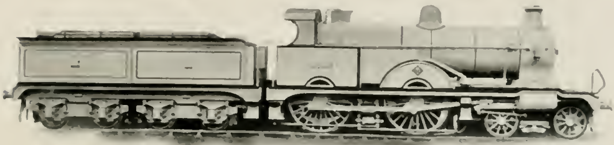
The Mechanism of the Motive-Power.

WITH a great number of people the fascination of the railway system lies in the phrase with which I have headed this chapter—the mechanism of the motive-power. Such phenomena as the economic revolution wrought by railways or the problems of organisation they involve, make but a limited appeal to the imagination, compared with the interest and charm of the machinery by which the traffic is moved. Will this interest and charm be enhanced by the entrance into the field of railway traction of that strange, invisible power which we call electricity? I doubt it. The steam locomotive in its general outlines is a piece of mechanism comparatively easy to comprehend. We call it the "iron horse," and the analogy of its parts with those of a living animal is close enough to make the simile an apt one. Steam is as the breath of life to the locomotive, being inhaled and exhaled to and from the cylinders, which act as lungs, while the boiler fulfils functions analogous to the digestive organs of an animal. But the generation of electricity, and its application to the work of moving a train, are matters far more complex, and most of the work is done outside the range of vision of "the man on the station platform," whose delight it is to stare at "the man on the footplate" and study the points of his iron steed before starting on a railway ride. Should the steam locomotive be superseded by the electric current, railway travelling may become cleaner, quicker, and more pleasant, but the iron horse will be missed by many whose affection for it could hardly be greater were it actually a thing of flesh and blood. A famous steam locomotive soon acquires in the eyes of such enthusiasts an individuality all its own; its genealogy, name, and achievements all help to endear it to the thousands who follow its career with interest from the erecting-shop to the scrap-heap. It seems hardly possible to conceive of similar sentiments being aroused by the reciprocating engines or turbo-generators in an electric power-station, or by the motors or contactors carried on an electric train.

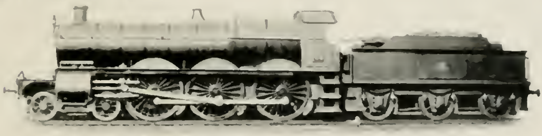
However, electric traction as applied to heavy railway work is still in its early childhood, while the steam locomotive is very far from decrepitude; on the contrary, never did it show greater evidence of vigour than at present. In every department the demands made upon the capabilities of the motive-power have enormously increased, and on the whole the locomotive superintendents have responded triumphantly. There has, it is true, been no marked increase in the maximum speed of railway travelling during recent years; indeed, the speeds attained nearly sixty years ago by Sir Daniel Gooch's famous engines, with eight-foot driving-wheels, on the Great Western, have never since been much surpassed. A mile a minute for the point-to-point run, with short breaks of seventy, eighty, or even ninety miles an hour on favourable grades, has been throughout its history the limit of the steam locomotive's record-breaking power. Gooch simply grasped the rather obvious principle that if you double the circumference of the driving-wheels, the distance they will travel in one revolution, and consequently the speed of the engine, will be in like proportion. But twice as much power will be required to turn the large wheels as the small ones; and you then encounter the natural law that the resistance to be overcome increases more than in proportion to the speed. This means that the capacity of the boilers, cylinders, and other parts of the locomotive must be greater, with a corresponding addition to the weight of the machine. But the weight per wheel is limited by the endurance of the permanent way, and the size of the boiler by the loading-gauges; consequently, we soon reach a point beyond which the size of the driving-wheels and other parts cannot be enlarged. In other words, there is a certain proportion of wheels, cylinder, and boiler—relative to the strength of the permanent way, the position of the side and overhead structures, and the loads to be hauled—which gives the maximum speed obtainable under all the conditions of operation.

The task of the locomotive superintendent of a British railway is not, as some writers would lead one to believe, to turn out machines designed for breaking speed records. He has to supply the motive power for doing the whole work of the line in such a way as to attain a reasonable combination of efficiency and economy, and at the same time not to fall short of the standard of accomplishment set up by the past achievements of the company or by the rivalry of its competitors. The strength of the permanent way—or, rather, its weakness—is often a seriously limiting feature, and so also may be the restrictions imposed by the loading-gauges; but it has of late years become an axiom of economical railway management that "the road must be fitted to the rolling-stock, and not the rolling-stock to the road." In the case of poor companies this axiom may be almost a "counsel of perfection"; but in several recent cases enlightened administrations have, at some risk of temporary financial embarrassment and at some sacrifice of popularity with shareholders, courageously grappled with the problem of strengthening the permanent way as a condition precedent to the introduction of larger and more economical types of rolling-stock. There is, indeed, no subject of anything like so much importance in railway management as that of having well-designed rolling-stock; and when the traffic conditions demand engines of greater power or vehicles of larger capacity, engineering obstacles should not be allowed to stand in the way. For although the cost of putting down heavier rails, of strengthening bridges, and of setting back structures

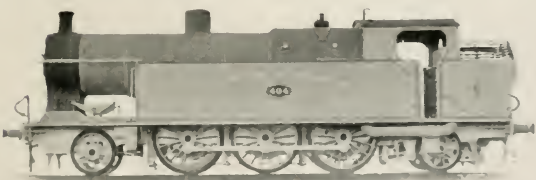
"PRECURSOR," TYPE OF EXPRESS PASSENGER ENGINE, L. AND N. W. R.



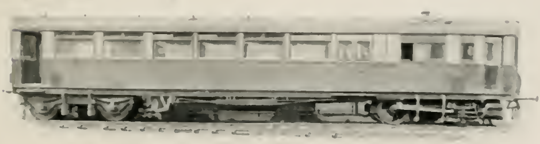
COMPOUND EXPRESS PASSENGER ENGINE, MID. R.
Photo by Locomotive Pub. Co.]



SIX-WHEELS-COUPLED GOODS ENGINE, G. W. R.
Photo by Locomotive Pub. Co.]



SIX-WHEELS-COUPLED SUBURBAN TANK ENGINE, L. AND Y. R.
Photo by Locomotive Pub. Co.]



STEAM RAIL-MOTOR, G. W. R.
Photo by Locomotive Pub. Co.]

may amount to a large sum, the amount may be dwarfed into insignificance by the savings accruing from the employment of increased wheel-loads in the haulage of the traffic.

All that is needed to increase the hauling power of a locomotive is to add to the weight on its driving-wheels, and to provide boiler power and cylinder capacity sufficient to turn them in spite of it. That is to say, the power of a locomotive depends on its adhesion and, as Mr. Sturrock, of the Great Northern, the *doyen* of our locomotive engineers, was wont to say, on "its capacity to boil water." But the weight on the wheels must have some relation to the material of which they and the rails are composed, for both wheels and rails will be crushed if the loads be too great. Hence it follows that the introduction of steel rails instead of iron, and the subsequent improvements made in the processes of manufacturing steel, lie at the root of practically all the advance which has been made by our railway system during the past fifty years, since the use of that material for rails and wheel-tyres has made it possible to double the weight carried on each wheel. Both the luxury and the cheapness of modern railway transportation are attributable primarily to this improvement.

Prior to the year 1872, the general practice of all English railway companies was to convey by the mail and principal fast passenger trains only first and second class passengers, third class passengers—*i.e.*, "penny-a-milers"—being compelled to travel by less important trains calling at a greater number of stations, or by the "Parliamentary" trains which stop at every station, and which the companies are bound by law to run over their lines at least once a day in each direction. In April, 1872, the Midland Company adopted the innovation, which was immediately followed by all competing companies, and more gradually by others, of conveying third-class passengers by all trains. From this change dates the great and continually growing increase in the weight of British passenger trains—an increase which has been but slightly mitigated by the abolition of second-class carriages on many lines, whilst it has been very much enhanced by other causes. Prominent amongst these have been the introduction of the Parcel Post, dating from 1883, and the now almost universal provision of dining and lavatory accommodation on all important expresses. These improvements, together with the luxurious sleeping accommodation provided on the fast night trains, have not only added much extra weight, but have very much reduced the carrying capacity of a given length of train, thus making it necessary to put on extra vehicles to accommodate the same number of passengers as before. Thirty years ago, the Scotch expresses on the West Coast Route weighed approximately 134 tons, and were timed at an average speed of 38 miles per hour. To-day some of our expresses weigh upwards of 350 tons, and they are timed to run 150 miles at a break, at a booked speed of over 55 miles per hour from start to stop. There you have in a nutshell the development of the demands made upon the locomotive department during the last thirty years.

To gain this absolutely necessary increased power under modern conditions, locomotive engineers generally have been expanding the cylinder diameters, increasing the boiler pressure, and enlarging their boilers to obtain increased heating surface, grate area, and steam space. The ordinary "simple" engine of to-day has cylinders varying from 18 to 21 inches in diameter, and in many cases a boiler pressure of 200 lb. to the square inch. But the British engineer, whilst he can enlarge his cylinders and increase his boiler pressure, has not the scope which engineers on younger railway systems enjoy, and his chief difficulty is to design a boiler of sufficient capacity to supply steam continuously, at the full working pressure, to cylinders whose piston surface has increased from 201 to 298 square inches. This difficulty originates in the fact that no locomotive in Great Britain may be more than 13ft. 6 in. above rail level at the highest point, whilst the width of every locomotive is restricted by station platforms and by the close proximity to each other of the British tracks

The difference between British and American conditions in this respect can be seen at a glance by referring to the diagram on page 88. The black line shows the external dimensions in width and height of a modern American engine, whilst the dotted lines show the external dimensions of the latest Lancashire and Yorkshire passenger engine, which has attained the extreme limit possible with the British loading-gauge. The heavy black lines show the British loading-gauge, which no dimension must exceed. This, without comment, will give some idea

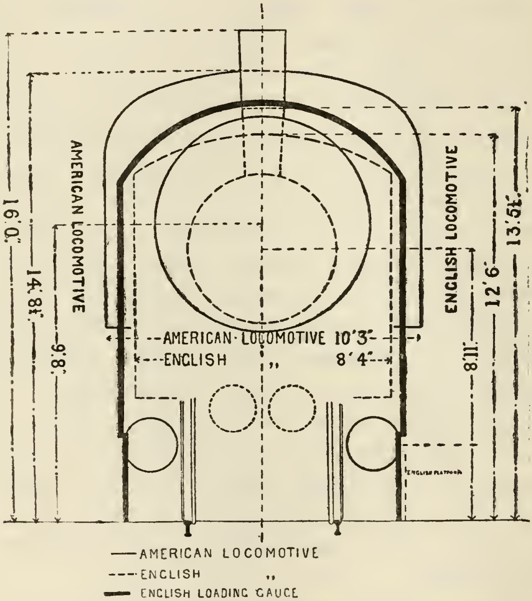
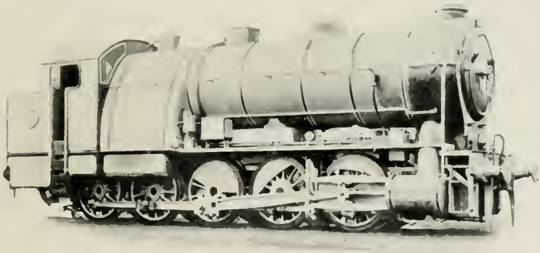


DIAGRAM SHOWING THE DIFFERENCE BETWEEN BRITISH AND AMERICAN CONDITIONS IN RESPECT TO LOCOMOTIVE DESIGN.

of the different conditions under which British and American engineers have to work to attain the same standard of boiler efficiency.

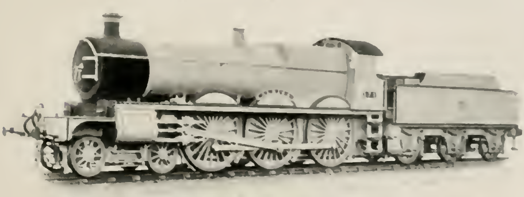
The necessity for providing for the heavy passenger

"LA FRANCE," EXPRESS PASSENGER ENGINE, G. W. R.
Photo by Locomotive Pub. Co.]



"DECAPOD" TANK ENGINE, G. E. R.
Photo by Locomotive Pub. Co.]

EIGHT-WHEELS-COUPLED SUBURBAN TANK ENGINE, G. N. R.



train loads has put an end to the reign of the big "single-wheelers" which made the names of Gooch and Stirling so famous in our earlier locomotive history. Most of the British express passenger engines of modern design have two pairs of coupled driving-wheels with a four-wheeled "bogie" or swivelling truck at the leading end to assist them in going round curves at a high rate of speed. In some cases there is also a small pair of "trailing" wheels under the back end of the firebox, this arrangement constituting what is generally known as the "Atlantic" type first introduced into this country by Mr. Ivatt, of the Great Northern, in 1898. Locomotives having six-coupled driving-wheels were adopted some years ago on the North-Eastern Railway for hauling the heavy East Coast Express traffic; but it was found that, while this arrangement admits of an augmentation of the efficacy of the adhesive weight by the extension of the area of contact between the "drivers" and the rails, it is attended by a greater amount of internal friction than is the case with the "Atlantic" type. In the newest North-Eastern express passenger engines, the latter (a 4-4-2) arrangement of wheels has accordingly been adopted, and also by the Lancashire and Yorkshire and Great Central. For hauling heavy loads up stiff gradients, however, the "six-coupled" type may be of great service in passenger working, as has been proved by Mr. M'Intosh, of the Caledonian Railway Company, on that wonderfully picturesque "corkscrew switch-back," the Callendar and Oban line, where grades of

1 in 50 or thereabouts are common. Some of the Great Western and Great Central latest express engines are also of this type.

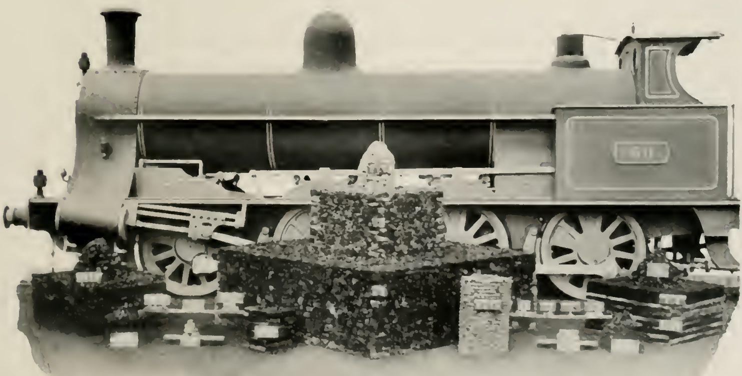
In the departments of goods and mineral traffic, a great increase in the weights of trains has been brought about by the necessity of working the traffic as economically as possible, so as to leave a margin of profit out of the low rates charged, particularly on the mineral class. For hauling the heavy mineral trains of the present day—the weight of some of which approximates to 1,000 tons—a very large amount of adhesive weight is required to permit the requisite draw-bar pull to be exerted at starting. Consequently, the most modern types of mineral engines on British railways are provided with eight-coupled driving-wheels, carrying the whole weight of the boiler and other parts. This type of locomotive was first introduced on the Barry Railway, in South Wales, in 1889—an example shortly afterwards followed by the London and North-Western Company, under the guidance of Mr. F. W. Webb, their late distinguished locomotive engineer. The Great Western Railway Company, on the initiative of their new locomotive superintendent, Mr. Churchward, have lately brought out a type of freight engine having the same number of coupled driving-wheels, together with a leading pair of smaller radial wheels. This is known as the "Consolidation" type, and was the first ten-wheel goods engine to be employed in this country, though the type is common in Canada and the United States.

The immense growth of the suburban traffic which has to be hauled daily in and out of London and other large cities has necessitated the provision of specially powerful locomotives for this class of work, not only because the trains are very heavy—weighing over 200 tons in many cases—but because the congestion of the lines and the number of stops demand the quickest possible acceleration and retardation—*i.e.*, as little time as possible must be consumed in starting and stopping. The Great Eastern, Great Northern, and Lancashire and Yorkshire Railway Companies have all recently brought out ten-wheeled engines for suburban passenger work, but the arrangement of the wheels differs in each case. In the Great Eastern "decapod," all ten wheels are coupled; the Great Northern's is an eight-wheels-coupled locomotive with a pair of radial wheels at the back, and the Lancashire and Yorkshire engine has only six of its wheels coupled, there being a radial pair both in front and behind. All three engines are what are known as "tank" engines—*i.e.*, they have no tenders, but carry their own supply of water and coal, the weight of which is thus available to increase the adhesion. In the case of the Great Northern and Lancashire and Yorkshire designs, the same boiler dimensions are provided as in the eight-wheels-coupled goods engines of these same companies. The Great Northern type was designed for quick acceleration and to improve the speed up the heavy gradients of the High Barnet branch. Mr. Holden, the designer of the Great Eastern "decapod," also aimed at quick acceleration, and in this he was wholly successful, a speed of 30 miles an hour being attained within 30 seconds from the start, with a load of 300 tons. But in order to get this great draw-bar pull at starting, he had to increase the weight on the wheels—notwithstanding there were ten of them to spread it over—to such an extent as to endanger the safety of the bridges over which the engine had to pass. Having regard to the possibilities of electric traction, the directors of the Great Eastern shrank from the expense of fitting their road to this exceptionally heavy type of locomotive.

This word "acceleration," it may be remarked in passing, is the key to the claim of electricity to supersede steam as the best motive power on urban and suburban railway lines where frequent stops are required. Whereas in the case of a steam locomotive the whole brunt of the starting effort falls upon the driving-wheels of the engine, with electricity the motive power can be applied to a large number of wheels throughout the train, thus utilising the weight of the carriages, and also of the passengers, for increasing the adhesion. Moreover, such part of the motive machinery as is carried on the train can be distributed over its length, so that there is not an excessive load on any one pair of wheels. Again, for the same weight on the "drivers" an electric motor can exert a much greater tractive effort than steam, because of the absence of the reciprocating motion in the driving-machine. In this respect the electric motor has the same advantages for

"ATLANTIC" TYPE EXPRESS PASSENGER ENGINE, N. E. R.

Photo by Locomotive Pub. Co.]



EIGHT-WHEELS-COUPLED MINERAL ENGINE, L. AND N. W. R.

Arranged in front are all the different raw materials required in the manufacture.

railway work as the steam turbine has for marine propulsion.

Advantages of a similar kind, though much limited in degree, are obtainable under steam conditions of operation by placing the motive machinery and the carriage on the same set of wheels in the form of a "rail motor-car." The Great Western and other railway companies have lately commenced to make considerable use of this class of vehicle in order to give a frequent and rapid service on lines of light traffic, usually where there is tramway competition to be fought against. When the number of passengers to be carried at a time does not, as a rule, exceed fifty, "rail motors" may be employed with success, and the frequency and acceleration of the service may be economically increased by their use; bu on most suburban lines the traffic conditions are not suitable for the running of single cars, except, perhaps, during a few hours in the middle of the day. Whilst steam has commended itself to most companies as the most suitable motive power for these "rail motors," the North-Eastern has adopted the "petrol-electric" system, which means that each vehicle carries on its back a small electric generating plant, driven by a petrol gasoline engine of the road motor-car type, whilst the Great Northern has experimented with direct-driving petrol cars.

Although the power of the locomotive depends primarily upon its capacity to generate steam by the boiling of water, and upon the adhesion which converts the expansive power of steam into draw-bar pull, the arrangement of the cylinders and their capacity to utilise the steam at high pressure also have an important bearing upon the result obtained. Here we touch upon the controversy, which has long raged and is still unsettled, between the advocates of "simple" and "compound" engines. The chief merit of the former system is, as its name denotes, its simplicity, and its champions assert that "compounding" whilst introducing additional cylinders expensive to construct, work, and maintain, gives in reality no greater power to a locomotive, except what is derived from the very high steam pressure employed. The advocates of "compound" engines retort that their system is necessary to allow the higher steam pressure to be properly utilised. As a practical answer to this, Mr. Churchward, of the Great Western Railway, has recently designed a "simple" engine—"Albion"—which employs as high a steam pressure as any compound—*viz.*, 220 lb. per square inch. This engine is being tested alongside the four-cylinder compound of the "De Glehn" type—"La France"—which the Great Western Company imported from that country in 1903 on the strength of the very fine achievements of that class of locomotive on the Nord and other French railways. Moreover, Mr. Whale, successor to Mr. Webb as chief mechanical engineer of the London and North-Western Railway, has brought out a new type of "simple" engine having a steam pressure of 175 lb. per square inch; and the comparisons between the performances of this type and the Webb "compounds" so long used almost exclusively on the North-Western will be of great interest in elucidating this vexed problem of locomotive engineering. The work so far done by Mr. Whale's "Precursor" type of "simple" express locomotive has been very satisfactory.

In France, there are now more than a thousand engines of the four-cylinder compound type in use, and it is claimed that they have enabled the French companies to increase greatly the weight and speed of trains without unduly enhancing the wheel-loads and without any large increase in coal consumption as compared with the "simple" engines previously employed. Generally speaking, however, the verdict of locomotive engineers who have the hardest tasks to perform in the matter of fast running, long distances between stops, and heavy trains, has been against the adoption of "compound" engines; and although engines of this class have done such good work in the past on the London and North-Western Railway, it is significant that Mr. Webb's successor at Crewe has come to the conclusion that an ordinary four-wheeled coupled engine, with cylinders 19 in. by 26 in., and a boiler with moderate steam pressure, well-proportioned heating surface and grate area, is from all points of view likely to be the most useful type that can be employed for dealing with the heavy passenger traffic of that railway. On the other hand, the Midland has been very successful lately with some compound express engines, having two low-pressure and one high-pressure cylinders. This arrangement, which is the opposite of Mr. Webb's, is known as Smith's compounding system. At the time of writing (August, 1905) several new types of compound locomotives are building for leading lines, and Mr. Ivatt, of the Great Northern, is making trials with a four-cylinder balanced compound "Atlantic" type engine in hauling the heavy express traffic of the East Coast Route. (*See Frontispiece.*)

As already stated, the principal British railway companies build as well as repair, maintain, and run their own engines, and in some cases more than a quarter of the whole staff of the concern is employed in the locomotive department. When it is considered that the head of that department is responsible not only for the discipline, but also for the work performed by an army that may perhaps exceed 20,000 men, a large number of whom are experts in various highly scientific branches of engineering industry, it will be realised that the burdens and cares of his office are anything but nominal or light. In addition to the work connected with the organisation and control of such a huge body of men, in itself no light task, the locomotive engineer has to devote in study the time necessary for keeping himself thoroughly up to date in all commercial and scientific engineering knowledge affecting his department, and in all the questions of applied science generally which are so intimately connected with the working and management of the mechanical engineering department of a railway. The headquarters of this department are in most

STEAM-SHED AT CREWE, L. AND N. W. R.

"PICK-UP" WATER-TROUGHS NEAR PETERBOROUGH, G. N. R.

cases situated outside London, at some convenient town near the centre of the railway company's system, whence issue the mechanical forces working throughout the length of the mileage owned or worked over, be it hauling crowds of holiday-seekers to and from watering-places, collecting coal from a labyrinth of collieries, or controlling the tides of daily traffic that flow and ebb, morning and evening, around and between the great cities of the land. And, be it remembered, the building and maintenance of locomotives is only a part of the duties devolving upon the locomotive engineer. There are many other mechanical appliances employed on a railway; and wherever knowledge of machinery is required in any form, whether it be the designing and erecting of coal-tips weighing 300 tons at a railway dockyard, or fixing a "dolly tub" in one of the company's steam laundries, the work finds its way to the department of the chief mechanical engineer.

When we consider the enormous spending power vested in the hands of this official, we realise that the commercial prosperity of a railway depends to a great extent upon the skill and care bestowed upon engineering manufacture and maintenance. In these times of keen competition, not a chance improvement in cost of production must be missed, not a point overlooked. A few pence too much spent in the purchase, manufacture, or upkeep of even a single small article, when multiplied by thousands may constitute a serious leakage, and very watchful care must be exercised to guard against any such waste.

It is, of course, quite impossible for all details to be brought before the man who sits in the chief seat of office, nor does any good general allow himself to be harassed with detail, when his time can be more profitably employed in dealing with weighty matters of principle and policy. To use the analogy of an army, the chief must rely upon his officers, the heads of the departments, who in their turn have their assistants to act as subalterns, and their foremen and inspectors as non-commissioned officers. By this means the links in the chain of responsibility are coupled together from the leading hand in the shop, or the foreman cleaner in the steam-shed, to the chief superintendent: and while each man in any position of trust has his own cycle of duties, which he can perform without troubling his superior officer, every question going beyond well-defined limits must come before the superintendent of his department, who in turn is held responsible for bringing matters of special importance under the notice of the chief mechanical engineer.

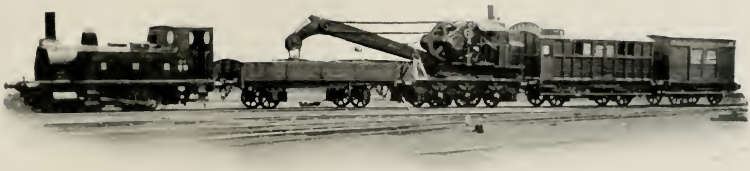
The two chief divisions of the locomotive department of a British railway are known as the "Works" and the "Running" departments, and on large systems there is a third chief division, known as the "Outdoor" department, to deal with matters lying outside the scope of the locomotive work proper. There are also other smaller sections, dealing with important work, scientific, engineering, or commercial, whose staff are confined within the walls of the head-quarters offices. These are the "Laboratory," "Drawing," "Accountants," and "Stores" departments, each of which has its responsible head.

Next in rank to the locomotive superintendent (who on large railways is now frequently styled "chief mechanical engineer") is the works manager, who, as a rule, assumes supreme control of the whole department in the absence of his superior officer.

In the London and North-Western Railway Works at Crewe—the largest of their kind in the United Kingdom—the process of manufacture goes back as far as the actual making of the steel, not only for building the engines, but also, amongst other things, for making the rails upon which they run. About 76,000 tons of steel are made at Crewe yearly, and converted into the thousand and one articles required for the purposes of the mechanical and permanent way departments of the system.

To give an idea at a glance of the amount of raw material that has to be converted and used up in various ways in the manufacture of a locomotive, an illustration is given, facing page 92, of one of the large mineral hauling engines on the London and North-Western Railway, and arranged in front of it are all the different raw materials actually required, either directly or indirectly, in its manufacture. Among these raw materials may be mentioned coal (chiefly used to make gas for heating the steel furnaces), steel scrap, pig iron, wrought iron, Swedish iron, spiegeleisen, ferro-manganese, red ore, and chrome (all used in the manufacture of different grades of steel), coke, cast-iron scrap, and lime stone (used for the manufacture of iron castings), block tin, antimony, copper, phosphor, and aluminium. All these are among the ingredients, if one may use the word, that are concocted in various ways according to highly scientific receipts in the manufacture of that most complicated "pot-pourri," a locomotive engine. Manifestly it would be impossible in the space of this chapter to take the reader through the process of making a locomotive. Even to allude to the multifarious operations going on under the roofs of workshops covering nearly fifty acres of ground is out of the question; but some idea of their magnitude and diversity may be gathered when it is mentioned that they range at Crewe from forging an axle, under a 2,000-ton hydraulic press, to making a three-sixteenth of an inch brass screw, 500 of which weigh $2\frac{1}{2}$ lb.

In the early days of railways, before their development brought about the necessity for departmental subdivision, engine-drivers were usually recruited from the ranks of men who had been mechanics, and most of whom had assisted in the building of the machines of which they afterwards took charge. However, as time went on, it became evident that these were two entirely different branches of locomotive engineering. A separate division of the locomotive department, therefore, sprang into existence, which was called the "running department," and it is this section that controls the whole of the locomotive staff engaged directly or indirectly with the working of the trains. On certain of the larger railways, as



BREAKDOWN TRAIN, L. AND S. W. R.

Photo by Locomotive Publishing Company.)

FORGING AN AXLE UNDER A 2,000-TON PRESS AT CREWE LOCOMOTIVE WORKS.

on the London and North-Western, where there are upwards of 11,000 men in the running department, it is for purposes of administration split into two subdivisions, which are again subdivided into districts. At every large station there is a locomotive depôt, called a "steam-shed," in charge of an official who is usually designated "district locomotive superintendent." This official is responsible for the working and maintenance of the locomotives within the area operated from his headquarters. The smaller steam-sheds in his district are called sub-stations, and are in charge of some capable man responsible to the district superintendent.

A breakdown plant, equipped with a powerful travelling crane, hydraulic jacks, and all the necessary paraphernalia for dealing with any kind of accident, is provided at each chief station, with a competent gang of men who must be prepared to accompany it, on being called upon, at any hour of the day or night.

The working of all regular engines, both passenger and goods, is arranged in the office of the superintendent of the running department, who allocates the number of engines to each district and appoints the trains they must work. The latter are arranged with the view, as far as possible, to give each engine-driver and fireman a reasonable day's work from every time of booking on, and (excepting in the case of long-distance goods trains) to enable him to finish at his "home" station. If the reader will glance at "Bradshaw," and imagine himself attempting the task of providing engines to work all the trains shown therein under the conditions I have just named, he will understand that the making of "working diagrams" for engines and engine-drivers is rather a complicated undertaking; and if he will further consider that passenger trains form only a small part of the train service of a big railway company, he will be able to form some idea of the intricacies involved.

The duties of the district locomotive superintendent are very diversified, and most of his work brings him in close contact with the operations of the traffic department. In addition to his technical knowledge, he should be fully conversant with the running of the trains in his district in order to get the best possible mileage out of his engines for the time they are in steam. Here is a fruitful source of leakage unless carefully watched. A locomotive engine is worth, roughly speaking, £2,500, and every minute of wasted time means that amount of capital standing idle, besides waste of fuel and enginemen's wages, so that it will be readily understood that the dividend-earning powers of the locomotive and the interest on the amount of capital it represents depend upon keeping it usefully employed in running profitable train miles. In former days it was rather the fashion for the head of each department to fight for his own hand, and I fear that state of things is not altogether unknown even in these days. But it is a ruinous policy where such a state of things exists, and thousands of pounds have been wasted by arranging train services without considering (and, indeed, often ignoring when pointed out) that a little "dove-tailing" in the interests of the two departments would save engines in steam and expense to the shareholders. On every properly managed railway it is considered of the highest importance that the traffic and locomotive officials should work "hand in glove" with each other, to arrange train services and engine-working with the greatest possible economy in engine-power. The desirability of modifying the staff organisation to further this end was alluded to in the first chapter of this volume.

From the time an engine leaves the shop until it "goes in" again for general repairs, it is in the hands of the running department, whose superintendent during that time is responsible to the chief mechanical engineer for its proper cleanliness, care, and maintenance. Its working parts require periodical inspection and repairs. Its boiler, alluded to already as analogous to the digestive organs of an animal, must have the strictest supervision; indeed, it is as liable in its particular way to almost as many ailments as those accredited to the human digestive organs by the advertising pill-vendor. It is the duty of the district locomotive superintendent to cure those ailments before they assume too acute a form. Where a boiler is supplied with water that does not agree with its internal working, the evil influence must be counteracted; for a lack of attention in this respect may, in the course of time, result in damage to the copper firebox, which will cost perhaps two or three hundred pounds to put right. The driver in charge of a locomotive is, of course, responsible for reporting at the end of his day's work any special repairs that are needed, but the district locomotive superintendent and his assistants must, in addition, keep an ever-watchful eye on every part of its mechanism that is the least likely to go wrong, and they are responsible for "stopping" an engine and sending it into the works as soon as its condition renders it necessary for that course to be taken.

The mileage an engine is capable of running between repairs, should no special defect occur, such as a cracked tubeplate or flawed axle, amounts to as much as 80,000, and sometimes 100,000 is the figure attained; but as a general rule it is found advisable to send an engine to the works when it has run 70,000 to 80,000 miles, because, although the engine may not be necessarily "run down," the wheel-tyres will have worn hollow and the flanges deep.

Minute care and careful observation on the part of the driver when examining his engine prior to starting out with his train are the best security for a successful run, and he should examine everything that could *possibly* go wrong, whether at all likely to do so or not. Notwithstanding every preventive care, however, there are many very small things which may cause the concentrated strength and herculean powers of a locomotive engine to be set at naught, and reduce it from a thing of superhuman energy and strength to a mere mass of dead weight and inertia. The least little bit of scale getting into

ELECTRIC TRAIN, N. E. R.

Photo by British Thomson-Houston Co.]

OIL-BURNING LOCOMOTIVE WITH TRAIN, G. E. R.

Photo by Locomotive Publishing Co.]

the apparatus for feeding the boiler may cause a shortage of water and consequent total disablement. The bursting of the little glass tube which records the height of water in the boiler may have a similar result, as may also the melting of about 3 oz. of lead in the plug screwed into the top of the firebox. Again, when we consider that the slightest suspicion of bad workmanship in the adjustment of a bearing or in the fixing of a pin an inch long in the valve motion may cause the total disablement of the mechanism of the motive power, it speaks volumes for the care and attention bestowed on locomotives that they should run millions of miles with punctuality and immunity from failure and accident. The engines of one British railway alone, the London and North-Western Railway, are running upwards of 72,000,000 miles per annum, which is equal in total distance covered to a journey round the world every three hours, or to the moon in twenty-nine hours, or to the sun in about every fifteen months.

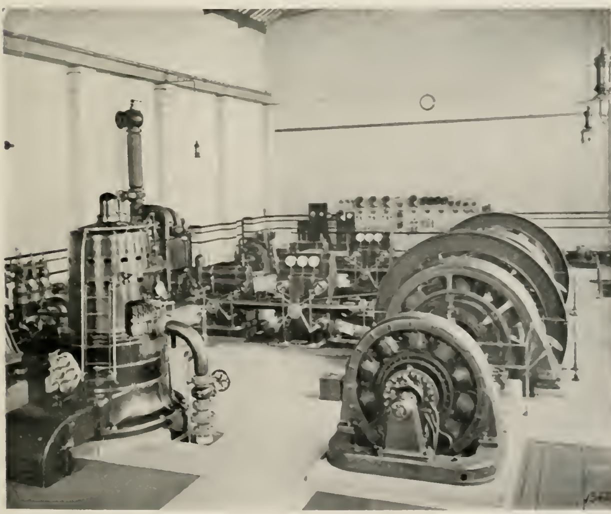
No animal, human or otherwise, can live without water; and again to liken the locomotive engine to an animal, we may remark that its digestive organs are consumed by a most rapacious thirst. The reader will gain some idea of that extraordinary rapacity when he is told that the locomotives on one large railway alone consume in the course of a year no less than 12½ million gallons of water. In the matter of solid food the "iron horses" of this company are no less rapacious, for during the same period it takes over 1½ million tons of coal to satisfy their appetites. The commissariat departments are, therefore, kept busy, and no small proportion of the labours of the coal-miners delving in the bowels of earth, and of the pumping-engines extracting water from the same source go towards providing solid and liquid refreshment for the rapacious maw of the "iron horse." Some companies—notably the Great Eastern—employ petroleum oil for fuel as an alternative to coal. In 1886, Mr. Holden, the locomotive superintendent of the Great Eastern, was led to devise a locomotive oil-burner by his desire to find a use for the waste product of the oil-gas works established by that company at Stratford for the purposes of train-lighting. When the oil has to be specially bought, however, it is usually found in this country to be dearer than coal.

As regards water supply, the chief mechanical engineer is responsible not only for the consumption of his iron horses, but for multitudinous other purposes. Whole towns, such as Crewe and Wolverton, are provided with water by railway companies, and every railway-station throughout the country, great and small, requires a water supply for domestic use. Then there are the large dockyards and goods warehouses, with their continuously working hydraulic machinery, all using an enormous quantity of water. For all these purposes the chief mechanical engineer is responsible for providing the necessary water supply, in addition to the yearly consumption of millions of gallons by locomotive engines mentioned above. The "outdoor" department deals with this matter, and the foregoing remarks will show that the office held by the head of that department is no sinecure.

In connection with the subject of a railway's water supply, we must not omit to notice the ingenious arrangement for enabling a locomotive to pick up water whilst running, which has done so much to facilitate long "non-stop" runs, since it was first introduced by Mr. Ramsbottom, the then locomotive superintendent of the London and North-Western, about forty years ago. Long confined to its inventor's own railway, it has since been adopted by others of our leading lines. All that is needed is a stretch of level line about half a mile in length in the neighbourhood of a spring of good, soft water. Along this stretch a trough is laid between each pair of rails, into which the engine-driver lowers a scoop without slackening speed, whilst the fireman stands ready to watch the rise of the incoming stream in the tank. In about ten seconds from the lowering of the scoop, the water is splashing up against the top of the tank. The driver and fireman, uniting their strength, hastily draw up the scoop again, and the train speeds on its way supplied with the raw material of tractive energy for another fifty or hundred mile run. A great advantage of this system, in addition to the delays which it obviates, is that it enables an engine readily to fetch its own water from a place where the supply is suitable for locomotive work, instead of having to put up with the quality —good, bad, or indifferent—available at the stations where in the ordinary course it would have to stop for water.

Not least amongst the advantages which electric traction promises to introduce into railway locomotive work is that it will no longer be necessary for each train to carry on its back its own supply of the raw materials of power—water and coal, these being utilised at the central generating-station, which can usually be located on a site convenient for their economical supply. But it is fairly safe to prophesy that the electric train will no more completely supersede the steam locomotive than the iron horse has superseded its prototype of flesh and blood.

THE ELECTRO-PNEUMATIC TUBE SYSTEM FOR THE COLLECTION AND DELIVERY OF RAILWAY TELEGRAMS. THE INSTRUMENTS INSTALLED BY MESSRS. REID BROTHERS AT PADDINGTON, LONDON, G. W. R.



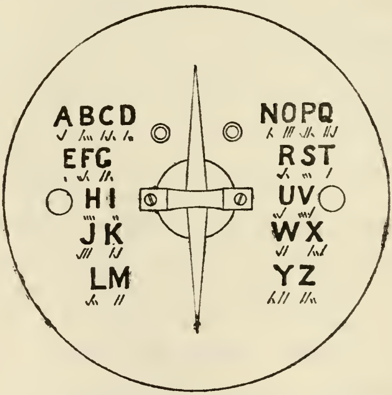
INTERIOR OF BRITISH THOMSON-HOUSTON COMPANY'S POWER STATION AT

CHAPTER V.

THE ELECTRICAL EQUIPMENT.

IT is not at the present time generally known that the first important adaptation of electricity to commercial use—in the form of telegraphy—was the outcome of the requirements of the railway service. Safety and efficiency in the working of lines of railway alike called for some means whereby the officials in charge of the traffic could be kept cognisant of the movements and relative positions of the various trains and vehicles. Oersted's celebrated discovery of the power of an electric (or, as it was then more commonly called, a voltaic) current to deflect a compass needle suggested to Mr. (afterwards Sir) William Fothergill Cooke a means by which instantaneous communications might be made from one railway station to another, and in conjunction with Mr. Wheatstone he established an experimental circuit between Euston and Camden Town on the London and Birmingham (now London and North-Western) Railway, wires covered in wooden trunking being used. The first electric telegraph for everyday working was erected in 1838 between Paddington and West Drayton on the Great

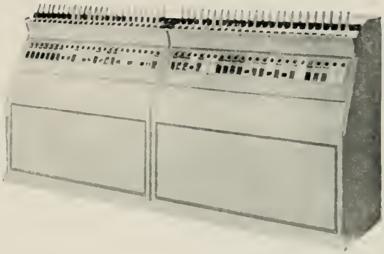
Western Railway, the wires being at first placed in a tube, but afterwards stretched on posts. Two years later the London and Blackwall Railway was opened, the trains being drawn, not by locomotives, but by rope-traction. It being desired to start a train every quarter of an hour in each direction, the electric telegraph was installed throughout the length of the line, and the whole traffic regulated by its agency.



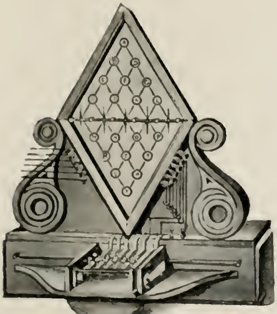
ALPHABET OF THE SINGLE-NEEDLE ELECTRIC TELEGRAPH INSTRUMENT.

The instrument used in these pioneer installations was the "five needle" telegraph, shown in the accompanying picture. It will be seen that only twenty different signs could be given by this apparatus, and that the letters c, j, q, u, x, and z were not represented, but had to be signified by

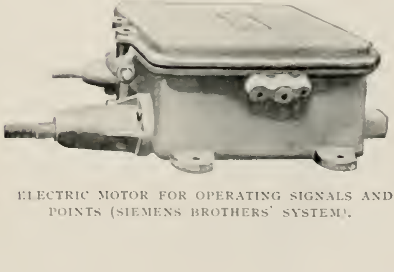
THE ELECTRIC TELEGRAPH INSTRUMENT NOW MOST EXTENSIVELY USED IN THE TRANSMISSION OF RAILWAY MESSAGES — VIZ., THE "SINGLE NEEDLE."



MODEL INTERLOCKING FRAME FOR OPERATING SIGNALS AND POINTS BY ELECTRICITY (SIEMENS BROTHERS' SYSTEM).



THE "FIVE NEEDLE" ELECTRIC TELEGRAPH INSTRUMENT USED IN ORIGINAL RAILWAY INSTALLATIONS.

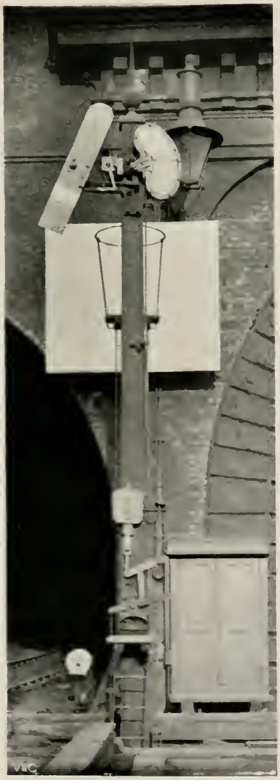


ELECTRIC MOTOR FOR OPERATING SIGNALS AND POINTS (SIEMENS BROTHERS' SYSTEM).

combinations of others. Soon after the telegraph had been installed on the Great Western, a murder was committed by a Quaker at Slough. It was suspected that the murderer, after committing the crime, had entered a train for London, and the aid of the railway telegraph was called in to follow up the clue. In sending the message to Paddington the operator had to spell the most important word "kwaker," owing to the lack of a sign to represent the letter q; but this phonetic spelling was readily understood, and on alighting from the train the man so described was astounded to find that the news of his crime had preceded him.

This incident made a profound impression upon the public mind, and created an immediate demand for the recognised use of the railway telegraph-wires for other messages besides those relating to the movements of trains, etc. Under these circumstances it would not have been surprising had the railway companies added the business of telegraph companies to their proper functions, just as later on they became road carriers and steamship, dock, and hotel owners. Instead of this, however, separate telegraph companies were formed, and those railway companies who had not got wires already fixed along their lines arranged with the telegraph companies to erect these. As a rule, separate wires were provided for the public and railway services, the latter being worked exclusively by the railway authorities. At busy centres the telegraph companies kept their own offices and staff of operators, but at the smaller stations the whole work—both public and official—was done by the operators employed by the railway companies under arrangement with the telegraph companies. Quite a number of these concerns grew up in more or less active competition one with another, such as the Electric Telegraph Company, which became the Electric and International on extending its lines across the German Ocean to the Hague, the British Electric and the Magnetic Telegraph, which were amalgamated into the British and Irish Magnetic, the London District, the United Kingdom, and one or two smaller concerns. The confusion which resulted led to the Government taking over the telegraph system of the United Kingdom in 1870, when the wires necessary for railway working were handed over entirely to the railway companies, and the others were reserved for the use of the Post Office. Those public wires which run along the railway lines are maintained by the companies under their agreements with the Government; and the railway companies still act as agents of the Postmaster-General for the collection of public telegrams at most of their stations, and in some cases for their delivery. Under modern conditions, however, the fact is becoming forgotten that the whole development of electric telegraphy, with its incalculable influence upon business and social life, was the outcome of the demand for an improved means of regulating the traffic of the pioneer railways of this country.

But for the electric telegraph it would be impossible to work railway traffic with any degree of



SIGNAL ELECTRICALLY CONTROLLED BY "INSULATED RAIL" AT ENTRANCE TO KING'S CROSS TUNNELS, G. N. R.

HILL OF HOWTH ELECTRIC TRAMWAY, GREAT NORTHERN RAILWAY (IRELAND).

PREPARING THE PERMANENT WAY FOR ELECTRIC TRACTION NEAR NEWCASTLE, NORTH-EASTERN RAILWAY.

[Photo by British Thomson-Houston Co.]

frequency except at perpetual risk of collisions. With its aid the working even of frequent trains in both directions over a single line (with passing places) has become absolutely safe—supposing rules are obeyed; whilst on double lines trains can be started one after another in the same direction at as short an interval as two minutes. Indeed, on the Central London Railway as many as thirty-one trains have been got away from the Bank station within a single hour, following one another with perfect safety over the same pair of metals. This is the triumph of the "block system" of railway working, which was first put into operation by Messrs. Cooke and Wheatstone on the Norwich and Yarmouth Railway in 1844. The one weak link in the chain of the block system is that the telegraphic communications upon which its working depends must all be transmitted into signals through the agency of fallible human beings stationed in a series of cabins along the length of the line, whilst these signals in turn must by fallible engine-drivers be translated into those stoppings and startings of trains at critical moments upon which the safety of the passengers depend. It is an open question whether any mechanism which human ingenuity can construct can be less fallible than the human brain itself, but, whereas human failures are so varied and erratic as to be incalculable, the failings of mechanism can be foreseen and guarded against, so as to produce a system in which the chances of dangerous error are infinitely small.

Thus the perfection of railway signalling tends more and more to supersede human action by machinery, in which process electricity is playing every year a larger and more important part. Out of simple telegraphic signalling, the "block" system was developed. Then came the "lock and block" system, which, as its name implies, so interlocks the telegraph instruments with the outdoor signals as to compel each signalman to maintain a clear section between following trains. Then followed the "insulated rail," "rail-contact," and "treadle" systems, which all make the train itself the agency in preserving the clear section behind it; and these in turn were developed into the "track circuit" system, which converts one rail of each track into a telegraphic conductor, so that the trains themselves are continually signalling to one another by opening and closing circuits as they pass up and down the lines. Finally, we have the track circuit system combined with an automatic train-stopping apparatus, so that electrically operated mechanism performs, on sections of line where there are no junctions, the functions both of signalman and engine-driver, visual signals being rendered unnecessary, and each train stopping of itself when the electric current passing through the rail communicates to the brake apparatus the fact that there is an obstruction in the section ahead. Nor, if this system be perfected, need the protection be confined to a single pair of metals. Suppose a derailment occurs, and the parallel track is fouled by the locomotive falling across it. Instantly the electric circuit of that other track is

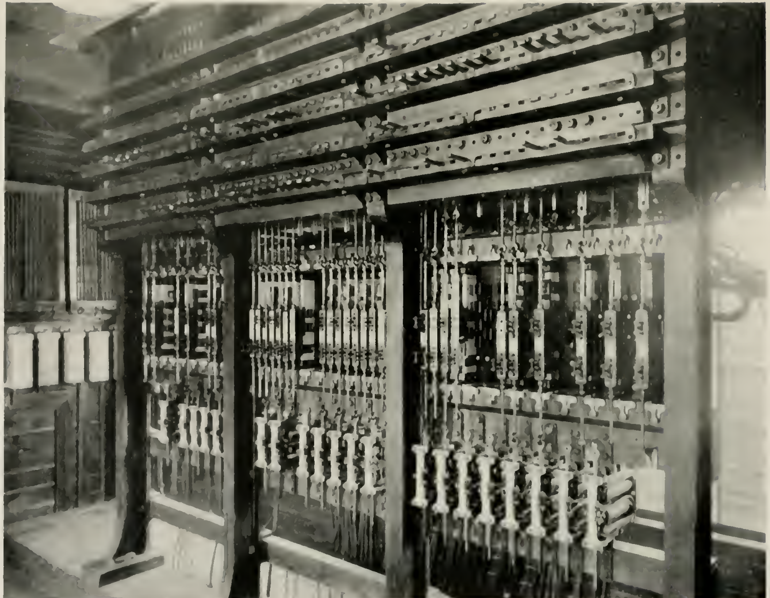
INTERIOR OF ENGINE ROOM, ELECTRIC LIGHTING STATION, HOLLOWAY, LONDON, G. N. R.

broken, and although every man on the derailed train may have been killed, and there be no one else in sight, the warning is flashed back in both directions automatically, and approaching trains are stopped on both tracks, instead of ploughing helplessly into the *débris*.

This, in very rough outline, is a sketch of the part to be played by electricity in an ideal system of railway operation. On the recently opened New York Subway the ideal is already realised, and the same system is now being put into operation on the Metropolitan District, and on the "tubes" which are being constructed under the control of Mr. Yerkes. The London and South-Western has several important sections of its main lines equipped with automatic signals operated by electric track circuit, but the automatic train-stop—or brake-applier—has not yet been adopted on any long-distance railway, except, partially, on the North-Eastern, in a non-electrical form, as described in the following chapter. The Liverpool Overhead Railway has been worked by automatic signals operated electrically on the "Timmis" system, ever since its opening in 1893. The "lock and block" system, whereby the signals and points are electrically interlocked with the telegraph instruments, was first introduced by Mr. W. R. Sykes on the London, Chatham and Dover Railway about twenty years ago, and it is now extensively used for working traffic in and out of very large terminal stations, such as Liverpool Street and Waterloo, in London, and St. Enoch's, Glasgow.

The Great Eastern's installation of "lock and block" on its suburban lines is very complete. Every stop signal controlling the trains on the suburban lines running out of Liverpool Street is normally locked at danger and cannot be lowered by the signalman until he has first asked permission from the signalman in the box in advance, which he does by ringing an electric bell. This permission the man of whom it is asked has not the power to give unless the preceding train has passed him and is well on its way into the next section. It is the actual presence of the train in this further section which by depressing an electrical "rail-contact" notifies to the signalman that his section is clear and gives him the power to permit the man behind him to admit another train. On the Great Northern for years past sections of the rails outside King's Cross station have been "insulated" in connection with the application of batteries, relays, and electric locks to the signals. Under this system the signalman is reminded of the presence of a train waiting for a signal to proceed, by the wheels and axles of the engine "short circuiting" the insulated section, the process putting an electric lock upon conflicting signals and giving the signalman both audible and visual indication of the position of the train, when it is out of his sight.

It is common knowledge that the telegraphic block system of railway signalling is supplemented at junctions of two or more tracks by the interlocking system, whereby the signalman is prevented from

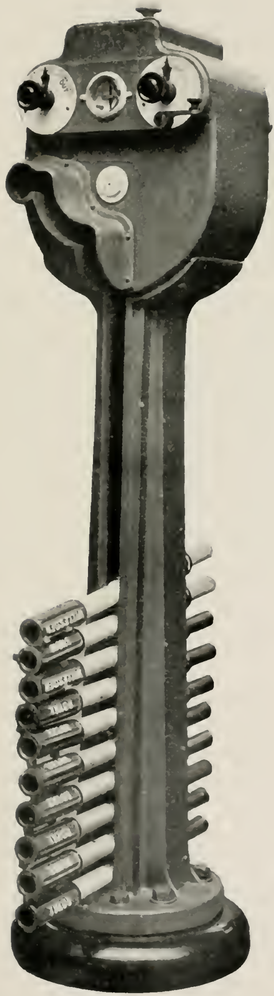


INTERIOR OF "ALL ELECTRIC" INTERLOCKING FRAME ("CREWE" SYSTEM), L. AND N. W. R.

pulling off signals or setting points which conflict one with another. In the ordinary form of interlocking, electricity is not employed, the work being done by horizontal and vertical steel bars contained in a frame beneath the levers in the signal-box, notches in which, by interlocking with one another, determine what movements of the levers can be made. This is sufficient for the safeguarding of the simpler kinds of junctions, but where there are a maze of lines crossing one another, it is necessary to supplement the mechanical interlocking with electrical locks of various kinds. In addition to its use in this and other ways as a controller of the signalman, electricity is also extensively employed in modern installations as the means of enabling the man to do the actual work of pulling over the signals and setting the points. In some systems, such as that installed on the London and North-Western at Crewe and elsewhere, and in the system patented by Messrs. Siemens Bros., which is being introduced on the Great Western and Midland, electricity alone is employed, and all the man has to do is to set electric motors at work by moving switches in his cabin, thus saving much manual labour as well as enabling the operations to be more quickly and efficiently performed. In other systems, of which the "Westinghouse" is the best known, pneumatic power does the actual work of movement, the function of electricity being to supply the agency whereby the signalman controls and directs the operation of the compressed air. This electro-pneumatic system of operating signals and points has been adopted in England by the Great Eastern, North-Eastern, and Lancashire and Yorkshire Railway Companies.

For the safe working of single lines of railway, electricity is used in the interlocking of the train-staff or train-tablet apparatus. No engine-driver is allowed to start his train from a station without having the staff or tablet, and the electric interlocking of the apparatus ensures that the staff or tablet cannot be issued from station A without the consent and co-operation of station B, and that when once a station-master, signalman, or porter has issued the "Open, Sesame!" to the driver, it is impossible for permission to be given for another train to move in the same section until the first train has restored the tablet or staff at the other end. In some cases, to make assurance doubly sure, the staff or tablet apparatus is also electrically interlocked with the signal and point levers.

It often happens on railways that a signalman from his cabin cannot see all his "distant" signals, owing to some of them being obscured by curves, bridges, or tunnels. In such cases the aid of electricity has for many years past been called in to keep him advised that his movements of the levers are properly carried out on the posts. For this purpose a miniature electric signal is placed in the box over the lever of each distant signal, and by means of a wire, a battery, and a device attached to the signal-post, the movement of the semaphore is repeated



ELECTRIC TRAIN STAFF APPARATUS
FOR SINGLE TRACK WORKING

in the cabin. By another electrical contrivance the condition of the light of a distant signal is indicated by a bell which automatically rings when the flame diminishes. This is ingeniously accomplished by a thermosat fixed in the signal-lamp, which is so arranged as to close an electric circuit when the temperature inside the lamp is lowered by the reduction of the flame. There is also fixed to the post a device whereby the removal of the lamp closes a circuit and rings a bell in the cabin. In a somewhat similar way the position of "points" is electrically indicated in the signal-box from which they are controlled, while at pumping-stations for watering locomotives, the same device is used for showing the height of the water in a distant tank.

At one time it was thought that the telegraph would be superseded for many purposes of railway working by the telephone; but notwithstanding the great utility of the latter, the use of the telegraph has continued to increase proportionately with the growth of railway business. It has been found that the telephone cannot be safely substituted for the block telegraph on double lines, nor for the train staff or tablet on single lines; but it may be, and is, used as an auxiliary to those appliances in place of the "conversing" telegraph, and so permits the employment of signalmen who are not trained telegraphists. Nevertheless, some of the principal railway companies still train all their signalmen in telegraphy before entrusting them with the working of cabins controlling running lines. In the hands of expert operators, the telegraph is a more trustworthy instrument of conversation than the telephone, as sibilant sounds cannot always be clearly transmitted by the latter agency. The telegraph is also the more expeditious means of communication for railway messages, and less costly to install, especially when worked on the duplex principle, whereby messages can be sent in both directions simultaneously over one wire. It has been found that half as many words again can be transmitted in a given time through the duplex one-wire telegraph as through the two-wire telephone. At places, however, where the services of telegraphists are not considered worth the extra cost of their training, the telephone is utilised —as, for instance, in the station-masters' and inspectors' offices and in shunters' cabins. It is also largely used for the collection and distribution of railway telegrams, though several large railway companies have installed a system of pneumatic tubes for this purpose at very busy centres, where as many as 7,000 to 8,000 messages are dealt with in the course of a day. At Liverpool Street station all telegrams received or to be despatched are transmitted through tubes, and the two telegraph-receiving offices on the platforms on the east and west sides of the station are also connected with the head office at Hamilton House by the same method. There are several miles of these tubes at Liverpool Street, constituting a miniature single-track railway system operated by air-power and worked by air-compressors situated about half a mile from the head office. The ringing

ELECTRIC GOODS LOCOMOTIVE, NORTH-EASTERN RAILWAY.
Photo by British Thomson-Houston Co.]

THE FIRST TRAIN RUN BY ELECTRICITY ON THE METROPOLITAN RAILWAY, LONDON.

ELECTRIC LOCOMOTIVE AND TRAIN, NEW YORK CENTRAL RAILWAY.
Photo by General Electric Co., New York.]

of an electric bell and a visual electrical indication announce the arrival of the carrier at each terminus, the whole operation being practically instantaneous, as the carrier with its load travels with lightning-like rapidity. There is a similar installation at Paddington.

For communications between the various departments of a railway the telephone is extensively employed, and there is a central exchange at every important range of offices. On railways which have administrative offices situated at more than one centre, the different telephone exchanges have been connected by means of "trunk" wires with highly satisfactory results, heads of departments or their assistants being able personally to converse one with another. All railway offices of importance are, of course, also connected with the public telephone system; but when an irate trader or traveller rings up the general manager to complain of a late train or a lost consignment of goods, he invariably finds himself wasting his flow of language upon an imperturbable office-boy, and he is seldom able to establish communication with any higher official. On the other hand, if his enquiry relates to tourist facilities or the despatch of goods, he is pretty sure to be immediately switched on to a suave head of department, especially if his enquiry relates to traffic for which another railway company competes.

Before passing from this branch of our subject we may note that the total mileage of wire employed by railway companies themselves in telegraphy was recently estimated at about 113,000, besides which about 86,000 miles of wire were maintained by the railway authorities for the Post Office. The total number of instruments employed was estimated at 158,597. These figures, which I take from an address delivered by Mr. Langdon, late electrical engineer of the Midland Railway Company, are stated by him to embrace "the principal British railways," and relate to the year 1901. Were statistics available of the whole telegraph mileage of the railways of the United Kingdom at the present time, the numbers would be considerably larger.

Next to its use as a means of communication—in the forms of telegraph, signalling, and telephone—electricity is most extensively employed by railway companies as an illuminant. A great deal of the work of railway operation has, it is needless to say, to be done under artificial light, and considerations of speed and accuracy of working as regards the *employés*, and of comfort and safety as regards the travelling public, have brought about the rapid introduction of electric lighting in many departments of the railway service. Mr. Langdon, in the lecture from which I have just quoted, estimated that in 1901 there were 7,182 arc lamps and 85,683 incandescent lamps in use on the principal British railways; and so great has been the progress made during the four ensuing years that I should think these figures might almost be doubled to give an idea of the extent of the use of electricity in railway premises in this country at the present time (1905). Electricity

OVERHEAD CONSTRUCTION FOR WORKING GOODS TRAFFIC BY ELECTRICITY. MANORS (NEWCASTLE) GOODS YARD, N. E. R.

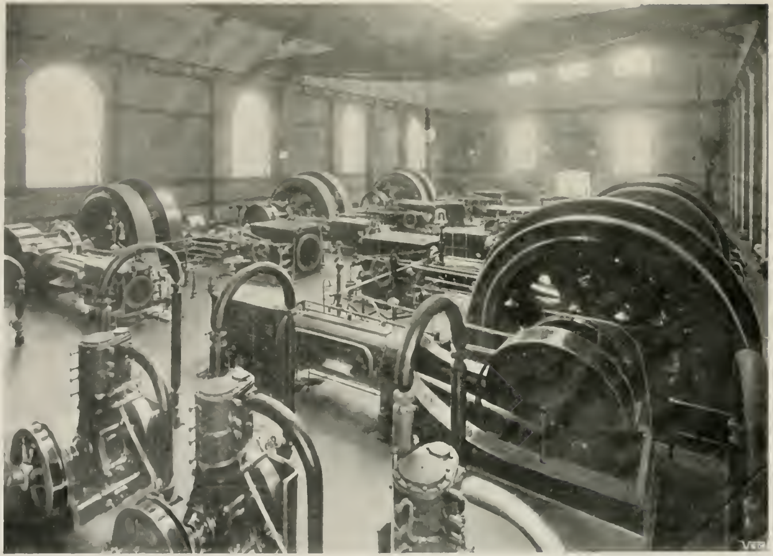
Photo by British Thomson-Houston Co.]

ELECTRIC TRAVELLING CRANE IN LOCOMOTIVE-REPAIRING-SHOP, DONCASTER, GREAT NORTHERN RAILWAY.

generated from the axles of carriages by the ingenious method patented by Messrs. Stone and Co., of Deptford, is also extensively used in the lighting of railway passenger trains, about 10,000 carriages being fitted with this system in the United Kingdom. Of course, where electric traction is employed, the whole passenger service is illuminated by the same agency.

It is an open question whether at the present day it is more economical for a railway company to erect its own electric-lighting plant or to draw the current from a public supply; but several of the companies who were pioneers in the use of electric light on their lines had really no alternative but to provide their own power-stations, as ten or twelve years ago, when the movement in favour of the electric lighting of railway premises first set in strongly, there were few public generating-plants capable of supplying the needs of a large railway centre. To-day we have the case of the North-Eastern Railway Company being able to take current from an electrical supply company, not merely for lighting and miscellaneous power, but for the electrical operation of its passenger traffic on thirty-seven miles of its system in the neighbourhood of Newcastle. On the other hand, the Lancashire and Yorkshire, which has electrified its line between Liverpool and Southport, has its private generating-station, and so has the Metropolitan Railway Company, which, in connection with the conversion of its system, has built at Neasden the largest power-station owned by any single railway company. The power-house now being erected at Chelsea by the Underground Electric Railways of London Syndicate is larger still, but this is for the supply of several "tubes," as well as for the Metropolitan District Railway. Each of the already opened "tube" railways of London—the Central London, City and South London, Waterloo and City, and Great Northern and City—has its own separate generating-plant.

Most of the principal railway companies of the United Kingdom have one or more electric generating-stations for the manufacture of light and miscellaneous power at important centres. The Great Northern Railway Company, for example, has for some ten years past had a power-house at Holloway, which supplies current on the high-tension system for lighting the stations, goods yards, offices, etc., over a section of railway extending five miles north of King's Cross, and covering an area of 318 acres. The output of this station is considerably over a million and a half units a year, which is larger than the outputs of two-thirds of the generating-plants belonging to municipalities and electric-lighting companies in the Kingdom. The Midland, which was one of the first of our railways to adopt electric lighting on a large scale, has a high-tension generating-plant at Highgate Road, Kentish Town, which lights the three passenger stations between that place and St. Pancras, the goods stations at that terminus and at Somers Town, the coal depôt, and the Midland Grand Hotel, as well as supplying power for various cranes, traversers, and pumps. At busy railway centres,



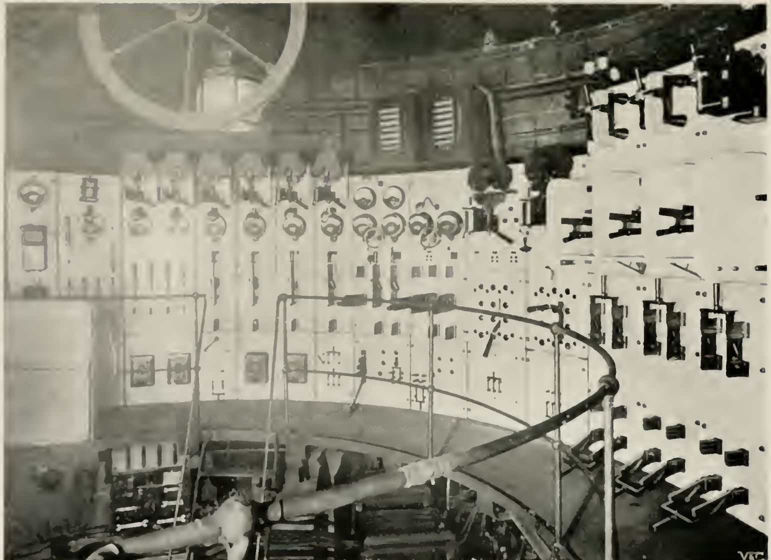
INTERIOR OF ELECTRICAL GENERATING-STATION, SHEPHERD'S BUSH, CENTRAL LONDON RAILWAY.

Photo by British Thomson-Houston Co.]

space and time are of the utmost value, particularly in the outdoor work. The ability, with a good system of lighting, to load and despatch five trains where four only could be dealt with under an inefficient mode of illumination, means a saving of twenty per cent. in capital outlay for extensions of the premises, besides a considerable daily economy in labour and rolling-stock. As public supply of electric current becomes general throughout the country, the use of electricity will probably supersede all other means of illumination in large railway stations and offices, and at the biggest centres the companies will probably continue to put down their own generating-plant, particularly when the current is wanted for traction as well as for lighting and miscellaneous purposes. At the present time the Great Western is building a very large power-house in the neighbourhood of Paddington.

The first electrically equipped line to be worked by a steam railway company in the United Kingdom was the tramway round the Hill of Howth, near Dublin, constructed a few years ago by the Great Northern Railway Company of Ireland. This pleasure-ground of the capital city of the sister Isle rises some 580 feet above the sea-level and commands an extensive view of Dublin Bay and its picturesque surroundings. The tramway is over five miles long, the first three and a half miles being on a rising, and the remaining one and three-quarter miles on a falling gradient. Although worked as an independent tramway, the line is of the standard Irish gauge, 5 ft. 3 in., so as to be capable of being linked on to any subsequent electrification of the company's system. The electric power is supplied from a special generating-station erected by the railway company at one end of the line.

The North-Eastern, the Lancashire and Yorkshire, the Mersey, the Metropolitan, and the Metropolitan District are the five English railway companies who, at the time of writing, have discarded the steam-locomotive in favour of electrical (steam-generated) power—the two first-named partially, and the other two wholly (in intention, if not in accomplished fact). For urban and suburban traffic the superiority of electrical over steam-locomotive traction is admitted, subject to some doubts as to whether so many passengers can be got through over a single pair of metals during the "rush hours," morning and evening, by electric trains as by the long trains hauled at present by the most powerful steam-locomotives. For a traffic the demands of which are fairly constant throughout the day, electric traction is admittedly far superior, as it allows of a more frequent service than is possible when each train has to be hauled by its own self-contained unit of power. Less time also is wasted in stopping and starting, owing to the superior "acceleration" and "deceleration" of the electric motor. These motors are not now generally run as separate vehicles (as was the case in the original equipment of the Central London), but are suspended beneath two or more of the passenger coaches composing the train. By an

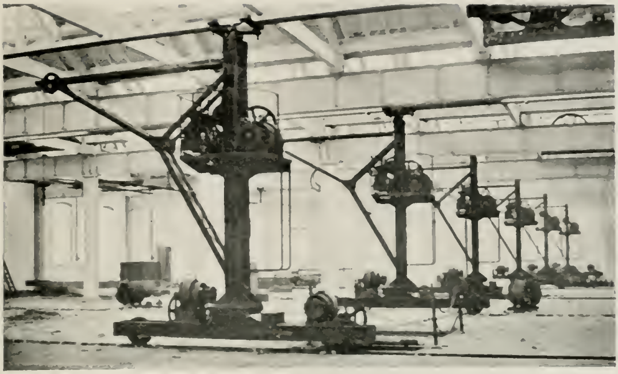


INTERIOR OF SUB-STATION FOR REDUCING AND CONVERTING ELECTRIC TRACTION CURRENT, NOTTING HILL GATE, CENTRAL LONDON RAILWAY.

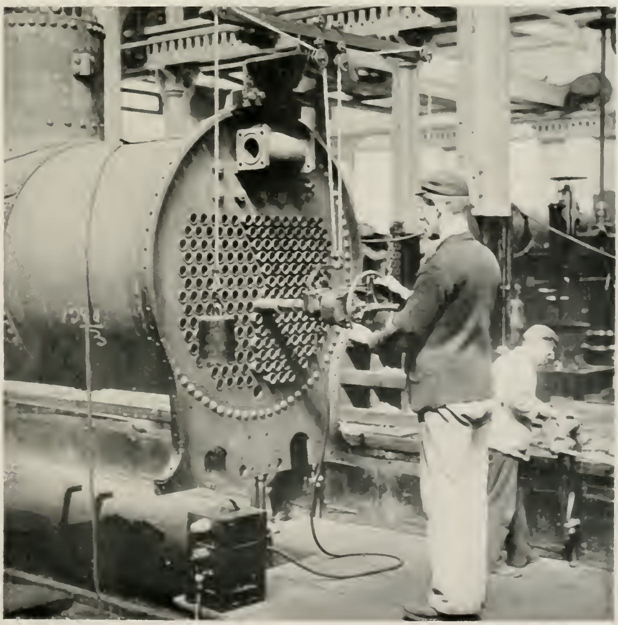
Photo by British Thomsen-Houston Co.]

ingenious system of "master-control" these "multiple-unit" trains can be driven from a single motorman's cabin; and as one of these cabins is provided at each end of the train, no terminal shunting is required. The motor-man simply walks through the train to the other end, adjusts a few switches, and the train is ready for the return journey. The multiple-unit system of operation was first introduced into this country by the British Thomson-Houston Company, the electrical contractors for the Central London Railway, and on every electric railway since opened for passenger traffic the same principle has been adopted. Indeed, except on the City and South London, which had already been in operation for about ten years, the use of separate electric motors for passenger working in the United Kingdom is unknown. For the haulage of goods trains it is, of course, necessary to have a separate motor, but so far electricity has not been adopted for goods traffic except on the Quayside (Newcastle) branch of the North-Eastern—a line with very steep gradients, and running mostly through ill-ventilated tunnels. For this service the British Thomson-Houston Company have supplied some very powerful electric-locomotives which are so equipped that they can draw their supply of current either from a conductor rail laid on the ground or from an overhead conductor.

The complete operation of a long-distance main line of railway by electric traction is a problem which no railway company in the world has yet tackled. It is a problem, not of power itself—for electricity can do everything which is required—but of the economical distribution of power. The system adopted on practically all our electric railways at the present time is for the current to be generated by means of steam-engines at a central power-station, conveniently situated as regards both coal and water supply. The electricity thus produced in the form of high-tension "alternating" current is transmitted by cables to sub-stations situated along the course of the railway at intervals of about five miles apart. Then the current is reduced by the agency of rather elaborate machinery from the high to a much lower tension, and it is converted from "alternating" to "direct" current. In this form it is conducted to the permanent way, which has been prepared to receive it by the laying down throughout the entire length of each track of a "third" or "conductor" rail. The motors attached to the trains are then able to pick up the direct current by means of a "shoe," and to convert it into hauling power. A return conductor has also to be provided, which either takes the form of a fourth rail or is supplied by the "bonding" of one of the running rails. The form of overhead conductor, familiar in the case of tramways, may be employed in place of the conductor rail, and this has been done at the Manors (Newcastle) goods yard of the North-Eastern, the electric locomotives which work in and out of that yard being provided with sliding bow "trolleys" as well as shoes, to enable them to pick up the current either from the third rail or the overhead conductor.



ELECTRIC "JIB" CRANES IN GOODS WAREHOUSE BRADFORD, LANCASHIRE AND YORKSHIRE RAILWAY.



ELECTRIC TUBE CUTTER (WEBB'S PATENT) IN USE AT CREWE LOCOMOTIVE

With a view of eliminating the costly sub-stations required under this system, and reducing the cost of the conductors, motors have recently been brought out which can be operated by high-tension alternating current—*i.e.*, by the electricity in the form in which it issues from the central power-house. This invention is expected greatly to expedite the conversion of long-distance lines, as it is estimated to effect a reduction in cost of equipment of from 25 per cent. to 30 per cent. The London, Brighton and South Coast Railway Company is about to equip a section of its line in the neighbourhood of London on this high-tension alternating current system, using an overhead conductor for feeding the current direct from the power-house to the motors on the trains. On the other hand, the New York Central Railway Company, which recently embarked upon the electrification of about forty miles of its lines in the vicinity of New York, has adopted direct-current motors. The electric-locomotives which have been built by the General Electric Company of New York for hauling the long-distance passenger trains of the New York Central between Croton and the Grand Central Station, are the most powerful in the world, and one of them on its trials developed a speed of seventy-two miles an hour with a train weighing 370 tons.

There are various miscellaneous uses to which electric power is put for the handling of goods traffic at railway stations, docks, etc. For working cranes, lifts, capstans, etc., electricity is the most economical power to employ when varying loads have to be dealt with; but when the load is constant, hydraulic power has the preference for this class of work. Wagon-loads of minerals, for example, can be best dealt with by water power. But for dealing with general goods, electrical machinery is usually the more economical, as the weights to be handled vary very much, requiring a continual adjustment of the power to the load, if waste is to be avoided. Special mention may be made of the electric cranes and capstans erected by Messrs. Cowans, Sheldon and Co., Ltd. (in conjunction with Messrs. Siemens Bros. and Co., Ltd.), at the Middlesborough and Hartlepool Docks of the North-Eastern Railway. The Lancashire and Yorkshire has also put down extensive installations of similar plant in its goods warehouses at Bradford and Bolton. In the workshops belonging to railway companies, where locomotives, carriages, and wagons are built and repaired, the use of electricity in place of direct steam, for driving cranes, hoists, and tools of various descriptions, is coming gradually into vogue as new plant is laid down, and great economies are being effected through the resultant centralisation of the power production and its more perfect adaptation to the work required. At the Doncaster shops of the Great Northern, for example, electric-motors totalling 2,000 horse-power are employed, and the system is being still extended At its Victoria Station, Manchester, the Lancashire and Yorkshire has had for some years past an overhead electric traveller for conveying hampers and luggage between

ELECTRIC TRAVELLING CRANES AT MIDDLESBOROUGH DOCKS, N. E. R.
Photo by M. Wright.]

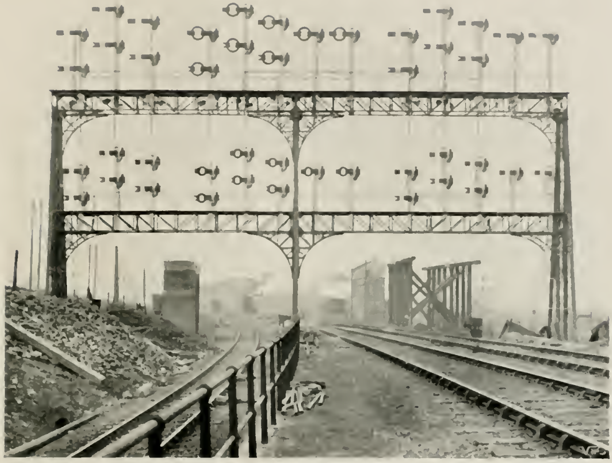
ELECTRIC CAPSTAN FOR SHUNTING WAGONS AT MIDDLESBOROUGH DOCKS, N. E. R.

the various platforms and the parcels office, and this has proved so useful that a second traveller has lately been installed. At large stations an electrical platform-indicator is employed to indicate to the officials and public the character of approaching trains and the platforms at which they will arrive. The indicator is connected with a transmitter in the signal-box. The same apparatus in a smaller form is used as a " train-router " between signal-boxes.

CHAPTER VI.

The Control of the Trains.

ROUGHLY speaking, four hundred million miles are run annually by trains over the 22,600 miles of our railway system. This means that about 18,500 trains run over each lineal mile during the year, or about fifty a day, including both passenger and goods traffic. That one train should run in each direction every hour over each mile of railway in the United Kingdom may not appear a very high density of traffic; but it must be remembered that the figure is an average one, including Sundays, and that nearly half our lines—9,800 miles—consist of single track, upon which the trains have to run in both directions. On the other hand, there are about 200 miles with three tracks, and over 800 with four tracks or more, as many as six or seven parallel-running lines being not uncommon for stretches of a mile or more in the neighbourhood of London. In the absence of full information as to track mileage, it is impossible to estimate exactly the density of railway traffic, but statistics show that no other country in the world except Belgium has anything like so many vehicles running over its railways, measured by lineal miles.



SIGNAL GANTRY AT RUGBY, L. AND N. W. R.

FOUR-TRACK AUTOMATIC SIGNAL GANTRY, L. AND S. W. R.

The art of railway traffic management consists in making the fullest possible use of the tracks as is consistent with safety and efficiency. A mile of railway is a piece of plant which may have cost anything from £10,000 to £500,000, and the upkeep of which costs round about £500 a year. The profitableness of such an investment must, of course, largely depend upon its full and constant employment. Given a good road and well-designed rolling-stock, the traffic manager's success or failure is in proportion to the amount of transportation he can turn out from his plant. If from ignorance of the resources of his art he calls for the construction of widened tracks or relief lines before he has properly filled the existing ones, he inflicts serious loss upon the shareholders from over-capitalisation of the property. If, on the other hand, he does not foresee the necessity of enlargement until the urgent need is upon him, a loss of revenue to the company is equally certain to result.

The chief aids to the traffic manager in the discharge of his duties are an able and well-disciplined staff, good signalling apparatus, plenty of brake-power on all classes of vehicles, and a well-constructed time-table. His great difficulty lies in the varying requirements of the business of the line, which demand the running of trains at irregular hours and varying speeds—some with many stops, others with few—and so disorganise the machine-like working of the plant. The simplest kind of railway, from the traffic manager's point of view, is a line like the

Central London "Twopenny Tube." This is practically an automatic machine for turning out twopennyworths of transportation. The machinery is complicated enough, but if kept in good order, its working is simplicity itself. Every train runs over the whole line from end to end and stops at every station. There is only one class of traffic carried, and the trains run at uniform intervals throughout the day. The fare charged is always the same, except in the case of the "workmen's" trains. Practically the only serious difficulty in the traffic management lies in the overcrowding during the "rush" hours, morning and evening. The pressure is then so great as to demand the utmost carrying capacity, but this is limited by the number and length of the trains possible to be run within a given time. To make the trains longer would mean a heavy expense in lengthening the platforms; so the efforts of the management have been directed towards attaining the utmost frequency of service. In this the terminal arrangements are the limiting factor.

When electric locomotives were employed, it was found impossible to shunt a train at the Bank or Shepherd's Bush in less than two and a half minutes, and this determined the time interval, or "headway," at which the trains could be run throughout the line. Since the adoption of the "multiple-unit" system—*i.e.*, motor-cars at each end of the train—it has been possible to reduce the shunting time to two minutes. If the Central London authorities succeed in their further plan of converting their line

ELECTRIC MOTOR-CAR, CENTRAL LONDON RAILWAY.

Photo by the Locomotive Publishing Company.]

INTERIOR OF CARRIAGE, CENTRAL LONDON RAILWAY.

Photo by the Locomotive Publishing Company.]

into a circular route, the terminal difficulty will be altogether removed, and the frequency of service will be limited only by the time taken in traversing the longest "block section"—*i.e.*, the longest section of line between signals. In preparation for the electrification of their line, the authorities of the Metropolitan District Railway are entirely remodelling their signalling arrangements with a view to running a two-minute service. In order to shorten the sections without extravagant expense for signalmen and cabins, they are introducing the automatic system described in the last chapter, whereby the trains themselves operate not only the semaphores, but the brakes, by means of an electric current running through the rails. With plenty of brake-power, block sections may be safely reduced to 1,000 yards in length, or even less, when the service is exclusively one of stopping trains running at moderate speed.

When the "headway" between following trains cannot be further diminished, the traffic manager still has the resource of increasing the size of each train, provided that the locomotive superintendent can provide the necessary increase of hauling power. This policy is now being pursued by the Great Eastern and Great Northern companies on their suburban lines. Both these companies make considerable use of widened carriages for suburban service —*i.e.*, carriages the sides of which are bulged out above platform level so as to provide an extra seat on each side of each compartment. Having exhausted the increased carrying capacity resulting from this regular daily service of warehoused goods arriving not later than 7 a.m., so as to allow time for delivery before business begins for the day.

These trains constitute the ordinary diurnal goods traffic of a railway, and their hours of arrival at their destination being practically fixed, the rest of their working is simply a matter of more or less skilful dovetailment with the other regular traffic of the line. The chief difficulty with regard to the arrangement of trains whose arrival and departure times on the outward trip are fixed by the requirements of the customers of the line, is to get an economical working of the engines and rolling-stock in the reverse direction. There is also the Board of Trade objection to men being on duty excessive hours to be reckoned with. The railway companies of the United Kingdom are required to make a return to the Board of Trade of all cases where the men in charge of trains are on duty over thirteen hours, and consideration for safety also makes such a limit imperative, so that besides arranging for the satisfaction of their customers, and for the economical use of their engines and rolling-stock, the railway authorities have to be extremely careful about the hours of work imposed upon their men. It is also very desirable to bring the train-men back to their home stations at the end of their day's work. All this entails very great care and skill in arrangement, and even with the best management, a considerable amount of "light" running cannot be avoided.

In the case of the "pick-up" trains which serve

CONTINUOUS-BRAKED FISH-TRAIN, G. C. R.

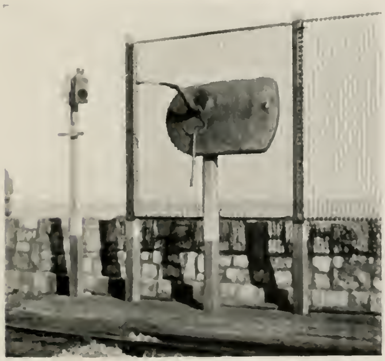
Photo by the Locomotive Publishing Company.]

INTERIOR OF MANUAL SIGNAL-CABIN, L. AND N. W. R.

the smaller towns and villages, the timings required by the public are less inexorable, and when a place of such minor importance is served by one railway only, there is temptation for the convenience of its trading population to be subordinated to economy in working, both as regards merchandise and passenger service. This, however, is a short-sighted policy, as it is bound to react upon the railway company by strangling the growth of traffic, if it does not lead to the construction of a competitive line. On the other hand, trains conveying coals, bricks, and other traffic of the mineral class may be delayed in running with comparative impunity so far as loss of custom is concerned, although the Railway Commissioners have recently decided that coal merchants whose freight is conveyed in their own wagons are entitled to receive a payment for "demurrage" from the railway companies if the trucks are not returned to them within a reasonable period. Moreover, prolonged delays of these trains are fatal to economical working, as they keep powerful engines unnecessarily long in steam, in addition to creating risks of accident and labour trouble by the excessive hours imposed upon the drivers, firemen, and brakesmen. For these reasons, all goods and mineral trains, and even trains of "empties," are as carefully "timed" as the passenger trains, with this difference, that the detail timings (as they concern nobody but the railway authorities themselves) may be altered by "staff circular" at a day's notice. Probably the trains whose "in-and-out running" is least likely to penalise anybody are the pleasure trains, and particularly the "special excursions." People who take five-shilling return tickets for a two hundred or three hundred mile ride expect to have "a good run for their money"; and having the whole day before them, and the resolve to "make a night of it" if necessary, they are not greatly inconvenienced or put out by an extra hour or two in the train.

Before the days of block signalling and the electric telegraph, the intervals between trains following one another on the same track could be measured only by the times of their successive departures from each station. In the event of a breakdown occurring out of sight of the stations, a collision under this system was inevitable, unless the driver saw the obstacle in front in sufficient time to stop his train with the very imperfect braking appliances then available, or the driver of the "wreck" could send his guard back to the nearest signal station in time to have the semaphore set at "danger." Under these conditions, when an exceptionally large number of passengers had to be transported from one place to another, the responsible officials occasionally collected all the available engines and carriages and made them up into one huge train, a mile or more in length, thus eliminating all danger of collision. Similarly, at the present day, short, single-track lines are sometimes worked with only one engine in steam, goods and passengers being conveyed in what are technically known as "mixed" trains. The chairman of a

APPARATUS FOR SINGLE-LINE WORKING, G. W. R.
The "staff," with looped handle, in position to be picked up by driver of a train passing at speed.



APPARATUS FOR SINGLE-LINE WORKING, G. W. R.
Showing the position of the "staff," after it has been dropped from the train

company owning a little railway in Ireland which was worked in this fashion, used every half-year solemnly to congratulate the shareholders on "the complete immunity from accident by collision which their line had happily enjoyed during the past six months!"

In all parts of the United Kingdom there are single-track railways many miles in length, the traffic upon which is as varied, though not, of course, as frequent, as on the double lines. At all the principal stations, passing-places are provided, the lengths of line between which constitute the "block sections." In order to prevent what the Americans picturesquely call "butt-end" collisions, the driver of each train has to carry a staff, or ticket or tablet, according to the type of safety system employed. The article which forms the "Open Sesame!" to each section is, as explained in the previous chapter, exchanged at each passing-place, where its insertion in the receptacle awaiting it is necessary to release another one with which it is electrically interlocked at the other end of the section; and also with some apparatus to free a "lock" upon the signals and points which have to be set before the train can go on its way. In the case of express trains running on single lines, this exchange of train-staff is often effected while the train is running through at a rate of thirty or even more miles an hour, the men engaged having become, by practice, adepts at handling the staves. Recently an "automatic train-staff-catcher" has been introduced on some lines, the working of which is somewhat similar to that of the well-known mail-catcher on the post-office vans. The conversion of a single into a double line is usually a gradual process, lengths of track being duplicated first at the more favourable locations and afterwards at places involving considerable engineering works. Most of our main lines, however, were constructed in the first instance with double-track.

At the time of the great trade "boom" which followed the conclusion of the Franco-German war, when our railway traffics went up by leaps and bounds, it was generally expected that a separation would have to be effected between the running of fast and slow trains, and that four tracks would be necessary on all main lines. The perfection of block signalling and the universal adoption of continuous brakes on passenger trains have, however, done very much to increase the carrying capacity of running lines; and the further remarkable improvements which have resulted lately from the employment of more powerful locomotives, and the partial adoption of continuous brakes on goods vehicles, have made it appear questionable whether some of the three- and four-track mileage already laid down may not be there before its time. The necessity for providing separate tracks for trains running in the same direction chiefly arises from their varying speeds. A remarkable feature of modern railway working in this country is the rapid levelling up of the speed of goods trains to that of passenger trains—an improvement which has been rendered possible by the

APPARATUS FOR SINGLE LINE WORKING. ENGINE-DRIVER PICKING UP "STAFF" AT SPEED, G. W. R.

equipment of the goods stock with continuous-braking apparatus. Quite recently I travelled on the Great Northern Railway from King's Cross to Peterboro' on the 3.40 p.m. "express goods," which conveys perishable produce from Covent Garden to the northern markets. With a total weight of 176 tons behind the tender, we covered the 67½ miles from Barnet to Peterboro' in 81 minutes, which gives an average rate of fifty miles an hour. For the whole journey north of Barnet we followed the 3.45 passenger express on the main running lines, though for the greater part of the distance there are duplicate lines specially laid down for the goods traffic. But there was no need for any signalmen to put us upon these, because, thanks to the high speed we maintained, there was no risk of our delaying a following passenger train.

We have seen that the times of arrival of the principal goods trains at large towns are inexorably fixed by the requirements of the consignees. Their times of departure from their starting-points must, therefore, depend upon the speed at which they can be relied upon to perform the journeys. In the days when the speed of goods trains seldom, if ever, exceeded thirty miles an hour, and averaged about twenty miles, it was impossible to delay the starting of urgent consignments until a full train-load had accumulated; it was better to divide the freight into two or more lightly loaded trains, so as to ensure punctuality with at least part of the goods. Now that forty and even fifty miles an hour have become common speeds for "fast goods," the times of departure from London and other large towns can be proportionately postponed, and the fullest possible loading secured both per train and per wagon. Therefore, increased speed for goods traffic means not only a shortened occupation of the running lines by each train, but the reduction of the number of the trains which run.

In the case of trains carrying coal and other traffic of the heavy class, similar advantages have accrued from the employment of engines having three or four pairs of coupled wheels and large boiler capacity, as described in Chapter IV. The loads which can be drawn, of course, vary with the gradients of the lines; but whereas a train of forty loaded wagons was considered a long one a few years ago, fifty- and sixty-truck trains are now quite common; and on the Lancashire and Yorkshire and Great Central lines through the flat lands of Lincolnshire, the docks traffic of the Humber ports is conveyed frequently in trains half a mile long, the number of wagons sometimes amounting to 100. Such huge trains as these may be unduly cumbersome to work if they exceed the length of the shorter block sections and passing-places, or if they break in two through excessive strain upon the couplings. With these qualifications, and provided also that the locomotive power is adequate, increasing the length of goods trains has much the same effect as increasing their speed. It reduces the number of trains and the occupation of the running lines.

STANDARD SWITCH, L. AND N. W. R.

There are on most railways certain slack hours of the day when both passengers and general goods traffic is light. If the coal and other heavy freight can be sent through in large loads, a great many delays will be avoided which must otherwise occur if coal trains have to take their turn when the lines are crowded with miscellaneous traffic.

The stop-at-all-stations, or "Parliamentary," passenger trains and the pick-up goods trains are the class of traffic for which the provision of duplicate running lines under modern conditions of working seems the most desirable. But by employing engines for this class of traffic which are quick starters, and by having the best possible brake equipment and the shortest possible block sections, trains of this class can be run with safety at comparatively short "headway" in front of expresses, if there be "avoiding-lines" for the fast traffic at all the principal stations *en route*. The refinements of modern railway signalling, as we saw in our last chapter, make it almost impossible for a signalman to give "Line clear!" to an express whilst a slow is occupying the section ahead or is foul of the junction points, except by such an almost incredible error of judgment as caused the recent disastrous accident on the Southport electric section of the Lancashire and Yorkshire Railway, when the signalman, by his own confession, rejected the clear warning given to him by the interlocking mechanism. Nor is it now considered necessary for a train to go through the cumbrous process of shunting backwards when it desires to get into a refuge out of the path of a following express. The improved construction of "points" and their intricate interlocking with the signalling apparatus so as to ensure that no semaphore shall be lowered until its "road" has been properly made and "detected," now permit of trains being allowed to pass over "facing points" almost without slackening speed. Consequently modern passing-places and relief-lines are usually constructed in the form of loops, thus enabling a train to run off the main track and then on to it again without any shunting.

With frequent "double-ended" passing-places, "avoiding-lines" for express traffic through stations, and plenty of terminal accommodation, there is not now any occasion to have separate tracks for fast and slow traffic, except in the neighbourhood of large towns, where there is a large suburban passenger business to be provided for. But, of course, when a line forms the trunk of a large number of important routes, each carrying almost its full quantum of traffic, fast and slow, it may be necessary to have more than two main running tracks nearly all the way from the junction where the routes converge to the principal terminus. This is the case, for example, with the main line of the London and North-Western between London and Crewe, that town being the point of convergence for practically all the longer-distance traffic of the system—Scotch, Irish, Welsh, Manchester, Liverpool, Leeds, etc. The unique position of Crewe in respect to concen-

ENTRANCE TO WATERLOO STATION, L. AND S. W. R.

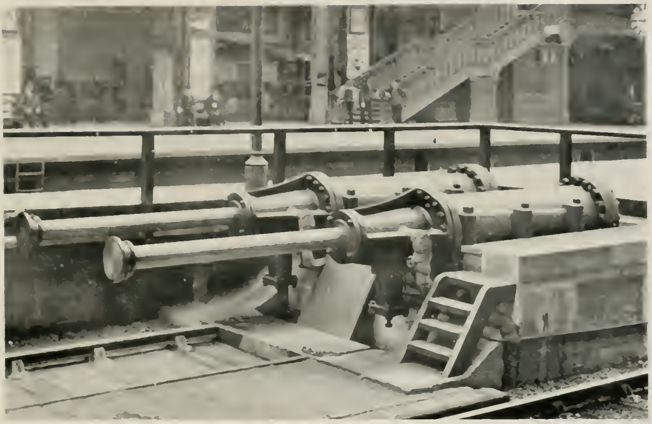
Photo by the Locomotive Publishing Company.]

EXPRESS TRAIN APPROACHING CREWE STATION, L. AND N. W. R.

tration of important traffic has led to the establishment there of a goods "tranship-shed," analogous to a postal sorting-office. When truck-loads cannot be made up from point of departure to destination, the goods are, first of all, consigned to Crewe for transhipment; and such is the quantity received there daily from all parts that it is possible to make up a full load for almost every place in the United Kingdom. In this way the use of wagons is economised and more efficient working secured.

As already indicated, the working of suburban passenger traffic is a problem of a special kind, demanding the utmost possible carrying capacity, frequency, and speed of service, within a few hours morning and evening. Hence it follows that a suburban business of any magnitude absolutely requires the provision of separate running-lines. It also demands very extensive terminal accommodation, the time taken in shunting the trains at the terminus being, as I have already shown, the limiting factor in respect to the frequency with which the trains can follow each other in and out. The usual practice is to have a series of platform "bays," spreading out, fanlike, from the running-lines, each of which is used both for the reception and despatch of trains. In a short siding attached to each "bay," or in some other convenient location, there is always kept an engine in steam waiting to be attached to the rear of the next arriving train. By this simple process the train on arrival is immediately converted into one ready for departure. As soon as it has left, the engine which brought it in follows it out and is shunted into the siding to await the next arrival. Simple as this process is, however, it entails no less than eight operations on the part of the signalman controlling the "bay," and four occupations of the running-road, which means that a train cannot be got in and out again in less than about eight minutes.

One of the great advantages accruing from the use of electric traction for suburban service is that the engine-shunting above described is eliminated, as a "multiple-unit" train can be driven equally well from either end. All that is necessary is for the driver to walk from the motor-car at one end to the motor-car at the other. This improvement exactly halves the number of signal operations and track occupations necessary in reversing a suburban train and reduces the time taken in getting in and out of a "bay" from about eight minutes to three or four. In short, with electric traction each platform can do more than double the work it did with steam; and having regard to the enormous cost of terminal widenings in large cities, a change of motive-power, expensive though it is, may easily prove cheaper, from this cause alone, than the doubling of the station accommodation, especially as the new platforms will probably not be needed except for a few hours morning and evening. These considerations were foremost amongst those which induced the Lancashire and Yorkshire Railway Company to electrify their line between Liverpool and Southport.



HYDRAULIC BUFFER STOPS AT KING'S CROSS, G. N. R. (ERECTED BY MESSRS. RANSOMES AND RAPIER, LTD.)

WATERLOO TERMINUS, WATERLOO AND CITY ELECTRIC RAILWAY.

Photo by the Locomotive Publishing Company.]

It follows from what has just been said that celerity in the operation of signals and points is of the utmost importance in fulfilling the prime object of railway traffic management—*viz.*, the fullest possible employment of the transportation machinery. Safety in working is, of course, the prime object of railway signalling, and, apart altogether from humanitarian considerations, railway companies have the strongest possible pecuniary reasons for neglecting no available safety appliance. A single accident involving death and injuries to passengers may cost as much as £100,000 in compensation, to say nothing of destruction of engines, carriages, and permanent way. In the primitive stages of a safety device, such as the block system of signalling, it was usually found that the quick working of the traffic was hampered thereby; but as the device has been perfected, efficiency and safety have proved to be but the two sides of the same shield. Apart altogether from the cost of accidents, the dense traffic of British railways could not possibly be got over the lines without a rigid method of securing space-intervals between trains, although the compulsory adoption of that mode of working was at one time hotly opposed on the ground that it would seriously hamper the efficiency of the service. And so it did, so long as signalling-stations were miles apart. Similarly, the interlocking of signal and point levers, and the provision of detector bars, electric treadles, track circuits, and other appliances, for making sure that a road is properly "set" and unoccupied before a train is allowed to pass over it, may hamper the quick working of trains at junctions and in and out of termini, unless the art of the railway signal engineer keeps pace with the ever-increasing demands made upon it by the growing density and acceleration of the traffic.

Fortunately the engineers who make a speciality of this most important branch of their profession have been equal to the occasion. There is no part of railway work which has exhibited such constant and uninterrupted progress as railway signalling; and its complexities are now such as to make it practically a special study, which cannot be mastered except by years of apprenticeship. The most important modern development has been the substitution of "power"—pneumatic, electric, or hydraulic—for muscle in pulling over the signals or setting the points. Should this change become general, as it is likely to within the next decade or so, the brawny-armed, alert, and often perspiring working man, to whose strength and skill in operating his row of heavy levers all railway travellers owe so much, will become a thing of the past. His place will be taken by an operator of more clerkly appearance standing quietly in front of a machine resembling an elongated typewriter or piano. "I press the button, the power behind me does the rest," will be his motto. All he does is to send an electric current to complete a circuit, or a pneumatic one to open a valve, in a piece of machinery fitted to the signal or points which he wishes to operate. The result is that the power, be it pneu-

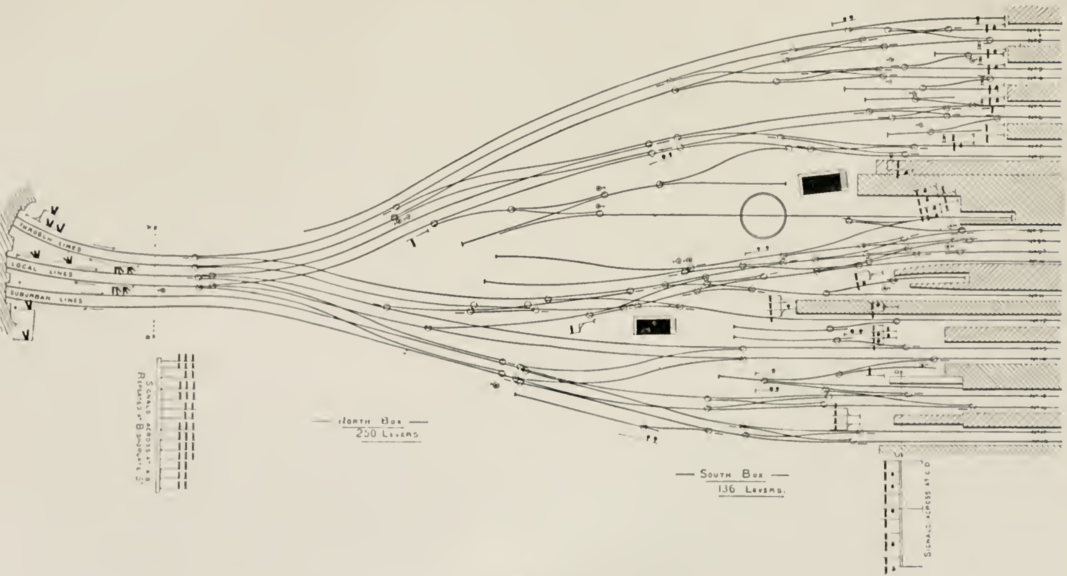


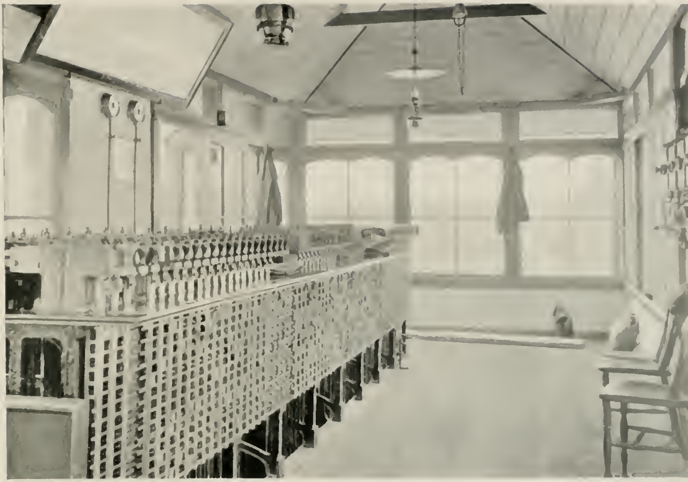
DIAGRAM OF CITY TERMINUS, LIVERPOOL STREET, G. E. R.

matic, electric, or hydraulic, is turned on to do the work, just as one switches on the electric light.

The chief advantages of the use of "power" in operating signals and points is that the work can be done more quickly and at a greater distance from the cabin. It has thus been found possible to replace two or more plants of the ordinary type by one "power" installation. Moreover, in the best type of apparatus it is arranged that a portion of the operating force returns to the cabin to release the interlocking, thus making absolutely certain that the semaphore has been moved, or the points set, before another lever affecting the same route can be worked.

The control of trains in time of fog, when the ordinary semaphore signals are not visible to drivers, is one of the most difficult and anxious problems of the traffic manager, and in this department of railway work the ingenuity of the engineer has, for once, proved unequal to the demands of the traffic department. Fog-signalling, as it is generally carried out on British railways, is practically the hand-signalling of primitive days, *plus* the use of detonators. Instead of waving a flag or lamp to signify "Line clear!" the fog-signalman fastens an explosive to one of the rails by means of a lead clip, in the pathway of an oncoming train. As a matter of fact, he always uses two detonators for each signal, in case one of them should fail to explode or should be pushed off the rail by the "skidding" wheel of the engine. In the "duplex" type of detonator, the two are packed together and can be fastened to the rail by a single clip. To guard against the risk of both detonators being "skidded" and at the same time to save the waste of the second if the first goes off, an ingenious appliance—invented by two officials of the Great Western—is in use on some lines, whereby the force of the explosion of the first is utilised to withdraw the second before the wheel reaches it. There are also mechanical appliances for placing detonators on the rails, one type of which enables them to be laid from the signal-cabin after the fogman on the ground has charged the machine; whilst another type makes it possible for a single fogman to signal a number of parallel lines without having himself to cross the metals. Huts or pits are commonly provided for the shelter of fogmen, who are also supplied with refreshments when on duty. Most of the men so employed are platelayers belonging to the engineers' department. A list of platelayers' names and addresses is kept in each signal-box, and sometimes, when they live in cottages belonging to the company, there is electric bell communication between the cabin and the fogmen's houses. Otherwise they have to be summoned by messenger when required out of ordinary working hours. When a fog comes on in the daytime, the platelayers have standing instructions to leave their work on the permanent way and repair each to his allotted signalling-station.

The number is legion of the inventions which have been brought out for superseding the human



INTERIOR OF PNEUMATIC SIGNAL-CABIN, GRATELEY, L. AND S. W. R.

INTERIOR OF AN ELECTRIC SIGNAL-CABIN, L. AND N. W. R.

agent by a mechanical, automatic fog-signalling appliance. The most complete of these is the electric automatic train-stop appliance, already described, by means of which an electric current running through the rail actuates a device for applying the brake on the train. The current, or "track circuit," is set in motion by the preceding train, if occupying the same block section; and so the system absolutely prevents two trains from being on the same length of line by automatically stopping the second as it is about to enter the section already occupied. This arrangement, as already stated, has lately been installed on the Metropolitan District Railway. A similar appliance—which works in conjunction with the signals—manual, "power," or automatic—has been in use for some years on the North-Eastern Railway, where it has proved very useful as a preventive of drivers overrunning signals when at danger. With the North-Eastern appliance—which is the invention of Mr. Raven, assistant mechanical engineer of that company—the brake is only partially applied, the sounding of a whistle on the engine at the same time warning the driver to complete the operation of bringing his train to a stand. The illustration given herewith shows the ground mechanism of this appliance "set" in position to strike the attachment on the approaching locomotive.

There are, of course, obvious objections to any system which takes the control of his train out of the hands of the man on the footplate. Nevertheless, the partial application of the brake by outside agency is a practice which has lately become general on British railways as a means of enabling a passenger to communicate to the driver and guards his desire that the train should be brought to a stop in a case of emergency, such as an attempted outrage or murder by a fellow-traveller. For this purpose a chain is now provided running through the train over the door of each compartment, the pulling of which by a passenger opens a valve in the brake apparatus.

With these two qualifications, the braking of passenger trains is in the hands of the engine-driver, unless he delegates it to his mate, the fireman, and except so far as he is assisted by the guard operating the brake-setter in his van. This also is the case with those goods trains which are fitted with continuous-brake apparatus. In the case of hand-braked stock, it is the duty of the guard and shunters to manipulate the lever attached to each vehicle, the driver of the train being responsible only for working the steam brake on the engine. It is a misfortune that a large part of British railway rolling-stock has to be "dual fitted" with continuous-brake apparatus. This arises from the fact that, while on about two-thirds of the mileage the "automatic vacuum" is the standard brake, the "Westinghouse" type has been adopted on the other third. Consequently dual fitting is necessary to make a vehicle interchangeable. The lengthening of trains, the shortening of block sections, and the desirability of securing rapid retardation have combined of late to create a demand

AUTOMATIC SIGNALS. VIEW SHOWING WORKS INSIDE BASE OF SIGNAL, L. AND S. W. R.

TRAIN-STOPPING APPLIANCE. THE APPARATUS IN POSITION PARTIALLY TO APPLY THE BRAKES OF AN APPROACHING TRAIN, N. E. R.

for a quicker action in the continuous-brake apparatus, in response to which both the Westinghouse and Vacuum companies have placed on the market an improved type of "quick-acting" brake.

As has been already pointed out, quick retardation and rapid acceleration are very important factors in increasing the capacity of crowded lines, and the very good results which have lately accrued from the application of continuous brakes to goods stock suggest that there are further benefits yet to be reaped by an all-round improvement in braking equipment. It is fair to add that one important railway—the North-Eastern—has already had about one-third of its continuous-braked stock fitted with the quick-acting type, which is also in use on a number of other lines in England and Scotland. Hydraulic buffer-stops have also been introduced by several companies in order to facilitate the stopping of trains at terminal stations.

Under the typical staff organisation of a British railway, as set out in the first chapter of this volume, the officer who (under the general manager), is responsible for the control of the trains is styled "the superintendent of the line." The department controlled by this official is split up into districts, each of which is under the control of a divisional superintendent. For the safe and punctual running of the trains in his district the divisional superintendent is responsible, and it is he who, assisted by a staff of inspectors, disciplines the station-masters, signalmen, guards, and porters. He has, however, no direct control over the engine-drivers and firemen, who, as already stated, belong to the department of the locomotive superintendent. Any complaints against the men on the footplate have, therefore, to be made through their own superior officers. This is another reason why the fullest harmony between the traffic and locomotive departments of a British railway is necessary to efficiency in working.

The time-tables are prepared in the office of the superintendent of the line and are usually revised four times a year. The most important alterations usually date from July 1st, when the summer tourist trains are put on, to be taken off again after September 30th. The preparations for the tourist programme of a large railway usually begin immediately after Christmas. The first thing done is for the superintendent of the line to call a meeting at headquarters, which all the divisional superintendents attend, together with one or more representatives of the locomotive-running department. At this meeting the leading features of the new summer time-table are outlined and handed over to the time-table clerks to be worked out in detail. Then a second meeting of superintendents is held at which the detailed timings of the new trains are discussed and approved. Minutes are then drawn up by the superintendent of the line for submission to the general manager, and through him to the traffic committee of the Board. The main point is how much new mileage the proposed alterations will involve, as from

MODERN CONTINUOUS-BRAKED GOODS TRAIN, G. C. R

Photo by the Locomotive Publishing Company.]

APPROACH TO NEWCASTLE CENTRAL STATION, N. E. R.

Photo by the Locomotive Publishing Company.]

this figure the additional cost to the company can be readily deduced. In times of "booming" traffic, a considerable increase of mileage may be expected to pass the Board; but if the weekly returns are showing decreases, an ambitious programme of new trains is almost certain to be referred back for curtailment. The approval of the general manager and the traffic committee having been secured, reference to the full Board is usually a mere formality, although a superintendent who has set his heart upon producing an epoch-making time-table cannot feel quite happy until the last of these preliminaries has been successfully negotiated. Then the time-table clerks can be set to work in earnest, and they have a busy six weeks or so until the last sheet has gone to press and the "formes" are in the printers' foundry.

The time-tables, or "penny books," with which the travelling public are familiar, are but an abridged edition of the ponderous tome compiled by those indefatigable scribes, the time-table clerks, and edited by that "burner of midnight oil," the head of the time-table department. This is the "working," or "service" book, which shows the running, not only of the passenger trains, but of every regular "goods" and "mineral," as well as of "light" engines and trains of empty coaches. In the case of the Great Western Company, these service time-tables form a work of over 1,500 pages, most of them crowded with closely printed columns of figures. As a copy of the working book has to be supplied to "every station-master, clerk, inspector, engine-driver, guard, signalman, ganger, shunter, gateman, and porter who is connected with the working of the railway," the cost and labour of printing and distributing so huge a volume every three months would appear to be appalling. In practice, the magnitude of the task is reduced by preparing the book in sections, each of which is published separately for the information of the local staff. These sections correspond with the areas administered by the divisional superintendents, and in the case of the Great Western they are fourteen in number. Whereas thousands of each of these sectional books are printed and circulated, the number of the complete volume required is counted in hundreds, its distribution being limited to the heads of the various departments. The Great Eastern has its own printing works at Stratford, but other companies contract.

At the Great Western Printing Works, Reading, where Messrs. Wyman and Sons, Limited, produce the working and public time-tables of that railway, the weeks immediately preceding the production of the books are a time of almost feverish activity. The time-table clerks belonging to all the divisions of the system then foregather inside the printing-office, so that there may be no avoidable delay between the pulling of the "proofs" and the correction thereof by the large staff of "comps" employed. The magnitude of the printers' task may be gauged from the fact that the type used in the time-tables weighs no less than thirteen tons, while fifteen tons more are needed for setting the platform "broadsides" and posters. This large quantity of type is never distributed, but is kept locked up in the "formes," which are carefully put away in racks specially provided for the purpose. In this way a new time-book can be produced from its predecessor with less expenditure of time and money than if every sheet had to be set up afresh. In days gone by, time-tables were often not produced until the very day on which the alterations took effect, thus causing much inconvenience to passengers, and provoking, it is to be feared, the utterance of some profane speech. It is now a point of honour with the leading companies to publish their books a week or a fortnight before the date of the alterations, and the passenger who selects from a June time-table, for a journey on the first of July, a train the running of which will then have been altered or superseded, has nobody to thank but himself if he does not experience a "transport of delight."

CHAPTER VII.

THE PASSENGER DEPARTMENT.

IT will surprise a good many readers to learn that the receipts of the railway companies of the United Kingdom from passenger traffic are not so large as their revenue from the carriage of goods. The difference, however, is not very considerable. Roughly speaking, the annual revenue of our railway companies from the working of the lines is £100,000,000, of which fifty-three per cent. comes from goods traffic, and forty-seven per cent. from passengers. On the other hand, the number of miles travelled by passenger trains throughout the kingdom is very largely in excess of the mileage of the goods trains, being 240 millions, as compared with 155 millions, whilst nearly two millions more miles are run by "mixed" trains, conveying both classes of traffic. It follows from the above figures that the goods traffic should be the more profitable branch of the companies' business, as it brings in a larger revenue than the passenger traffic, with a much less occupation of the companies' plant. But while goods traffic is the more profitable to haul on account of the larger loads obtainable, it entails a larger amount

PART OF THE INTERIOR OF LIVERPOOL STREET STATION, LONDON, G. E. R.
Photo by the Locomotive Publishing Company.]

A PLATFORM AT RUGBY STATION, L. AND N. W. R.

of expense at the terminal stations. Passengers to a large extent "handle themselves"; goods have, as a general rule, to be collected and delivered by cart at either end of their journey; and in many cases they have also to be warehoused—a service for which, under competitive conditions, the companies find it difficult to obtain adequate remuneration from their customers.

The great difficulty of railway management on the commercial side consists in the impossibility of getting at the actual cost of any single operation. Most manufacturers can gauge the cost of their products with sufficient accuracy to know for certain whether the price they are getting for each brings in a profit or entails a loss. In the railway business actual cost is an unknown and undiscoverable quantity. No compilation of statistics can ever enable a railway manager to know accurately what it has cost him to transport over any given distance "Mrs. Brown and her luggage," or a ton of coal. All the figures he has to guide him as to how much he ought to charge "Mrs. Brown" or the coal merchant are average figures—nay, they are not even real averages; they are averages based very largely upon estimate, which is only a polite name for guesswork. To quote Sir George Gibb, the general manager of the North-Eastern Railway*:—"A railway is worked as a whole; and although many items can be separated in the accounts, or allocated to particular services,

* Introduction to "The British Railway Position" by George Paish.

the residue, which no knowledge and no ingenuity can allocate, is so large that the result must always be a very distant and doubtful approximation to actual fact. This is not surprising when it is considered that the fact itself is of the nature of a metaphysical abstraction. There is no such thing, in fact, as the cost of moving a passenger by himself or a ton by itself. It is impossible to ascertain the separate cost of working passenger, goods, and mineral traffic on a railway, because these kinds of traffic are not separately worked, except in regard to some items of the service."

But for each passenger and for each consignment of goods or coal a separate charge has to be made, and therein lies the crux of railway management on the commercial side. In almost every other business the price of a commodity is based on its cost of production, but in the transportation business the cost of production cannot be ascertained except as "a very distant and doubtful approximation." A railway may be efficiently worked, and the shareholders may be receiving a sufficient, and not excessive, dividend; but it by no means follows that the customers of the line are being fairly charged. The goods traffic may be rated excessively and the passenger accommodation be unduly cheap and luxurious, or the passengers may be paying high fares and the traders receiving a despatch in the conveyance of their goods with which the rates they pay are not commensurate. But the shareholders rejoice in a steady dividend, and the general manager receives a knighthood; and the philosophers amongst the customers of the line console themselves that what they lose as traders they gain as travellers, or *vice versâ*. The unphilosophical clamour for a Parliamentary revision of rates and fares, or the nationalisation of the lines, or the compilation of ton-mile statistics, or some other fashionable nostrum of the hour; but the fact remains that the fixing of railway charges must always be a "rule-of-thumb" business. To quote the words of an outspoken member of Parliament, uttered sixty years ago, anent the work of one of our earliest "Railway Commissions": "Five angels could not have performed their duty satisfactorily, if they had come down from heaven and sat four hours a day as a Board."

"Get business—honestly, if you can—but get business!" was the reputed instruction of a pushful merchant to his subordinates. Without in the slightest degree impugning the honesty of the commercial branch of our railway administration, it may be said that from morning till night, and from 9 a.m. Monday to midday Saturday, "Get traffic!" is their rule of life. The time-table has been drawn up and the trains are running; success or failure depends on how completely they can be filled with traffic. That "facilities create traffic" is another saying current amongst railway managers; but the facilities must be studiously adjusted to the needs of potential travellers, and they must be widely and attractively advertised. These are the duties of the passenger department.

The number of passenger-journeys made over the railways of the United Kingdom has reached the stupendous total of over twelve hundred millions per annum. The exact figure cannot be given, as the number of journeys made by each season-ticket holder is an unknown quantity. It is certain however, that twelve hundred millions is well within the mark, and of this total considerably more than a thousand millions are made in third-class carriages, leaving the odd two hundred millions to be divided between the other two classes in the proportions of about two-thirds to the second and one-third to the first. The normal scale of rates for the three classes is, roughly, $2d.$, $1\frac{1}{4}d.$, and $1d.$ per mile; but the reductions on season and traders' tickets, and the low fares charged to "workmen," soldiers, sailors, volunteers, tourists, excursionists, "week-enders," golfers, anglers, etc., bring down the actual average fares for each class well below those figures. Probably the average fare paid by all classes of railway travellers in the United Kingdom is somewhere between $\frac{1}{2}d.$ and $\frac{3}{4}d.$ a mile, which certainly cannot be considered excessive, having regard to the accommodation given.

In granting powers to railway companies, Parliament has deemed it necessary to place them under limitations as to the maximum charges they may make to their customers, lest the monopoly of the ownership of the rights of transportation over a route should lead to an excessive tax being levied upon the travelling and trading community. As a matter of experience, most, if not quite all, of the railway companies of the United Kingdom have realised that high fares are incompatible with the fullest measure of commercial success. The reductions voluntarily made by the companies for commercial reasons have gone far beyond their Parliamentary obligations, except in the case of the workmen's traffic between suburb and city. This is a class of passenger-traffic rigid in its requirements as regards the times when the trains have to be run, and liable quickly to outgrow the facilities which can, without excessive expenditure, be provided for it.

Partly as the result of special obligations incurred in connection with the displacement of working-class dwellings formerly existing on the site of Liverpool Street Station, and partly as penalty for an over-generous policy towards suburban traffic in the past, the authorities of the Great Eastern Railway Company—which carries a larger number of passengers annually than any other line in the United Kingdom—now find that the conveyance of workmen from and to their homes morning and evening, is the acutest problem of its kind which they or any other railway company have to face, the traffic having grown so abnormally under the encouragement of the low fares. In 1899, the Railway Commissioners imposed 3*d*. return fares by trains arriving at Liverpool Street between 7 and 7.30 a.m., the then existing half fares, with a minimum of 4*d*., remaining in force by trains arriving between 7.30 and 8, in addition to which two special 3*d*. trains were imposed to run from Edmonton Station only, arriving at Liverpool Street between 7.30 and 8 o'clock, it being arranged that on these two trains the tickets should be issued to *bonâ fide* workmen only.

The fare imposed by Parliament in 1864 from Edmonton to London by the new line then sanctioned was *2d.* for the return journey of $17\frac{1}{2}$ miles by one train before 7.0 a.m., but as there was no terminal accommodation at the Edmonton Station on this line, the trains had to be run from and to Enfield, and the tickets were issued from the latter station at the same fare as a matter of convenience, and are now available by all trains reaching Liverpool Street between 5 and 7 a.m.

The carriages forming these workmen's trains are of the specially "widened" type referred to in our last chapter; and at the busiest times, when the traffic is at its height, the Great Eastern runs fifteen of these coaches in a train, all third-class, giving a total seating accommodation per train of 852 passengers. By this means the Great Eastern performs the remarkable feat of providing seating accommodation in trains running in one direction over one track for more than 11,000 passengers in a single hour, which number will be increased to about 13,000 when the lengthening of certain platforms has been completed. The remarkable character of this achievement may be gauged from the fact that the Central London Railway in its busiest hour can only seat about 9,000 people travelling in the same direction.

Despite all the efforts of the authorities, it has

A WORKMEN'S TRAIN, G. E. R.

Photo by Locomotive Publishing Company.

A CORRIDOR EXPRESS, G. N. R.

been found practically impossible to prevent overcrowding of these workmen's trains, owing to the incurable habit of the majority of the passengers of delaying their journey until the latest available train. The hours of pressure on suburban lines are between 6 and 10 a.m., and between 5 and 9 p.m. It has been calculated that during those hours the Great Eastern Company provides about 24,000 more seats than there are passengers on the Edmonton and Walthamstow lines, and that in every one of the hours there is an excess of seats over passengers. Yet such is the pressure to travel by favourite trains—the arrival or departure of which from Liverpool Street happens to suit the working hours of the passengers—that overcrowding daily occurs; and so loth are some of the customers of the line to give themselves the smallest margin for the journey that, even when there are seats vacant at the rear of a train, they will prefer to stand in already filled carriages at the front, so that they may get through the barriers at the terminus with the least possible delay. In order to cope with the extraordinary growth of its suburban traffic, the Great Eastern Company has lately incurred an expenditure of about £200,000 in widening carriages, lengthening platforms, and strengthening their engines in order to have longer trains, a large proportion of which outlay is attributable to the workmen's traffic. Most of the trains of widened third-class carriages have to remain idle except during the "rush" hours; and from various causes it is estimated that the cost of carrying the workmen is rather higher than the normal expense of running passenger trains on the line, though the fares they pay are in some cases less than one-sixth of the ordinary third-class charges. The company suffers indirectly also from the excessive local rating of districts inhabited exclusively by the working classes, such as Walthamstow and Edmonton. Under these circumstances, there is little likelihood of this or any other company taking any further steps to encourage the growth of low-fare suburban traffic, unless they are compelled to do so by Parliament.

The difficulty which is felt so acutely by the Great Eastern Company in reference to the daily workmen's traffic—namely, that a vast and ever-growing number of people all require to be carried over the same lines within a very limited period of time—also arises in a less degree in connection with all suburban traffic on railways. When a line is constructed primarily for long-distance traffic, it is undoubtedly profitable to the railway company to fill up the intervals between the main-line trains with full trainloads of short-journey travellers, even though these may be carried at exceptionally low fares, as is the case with suburban season-ticket holders. But it is impossible to regulate the growth of this class of business, and the point is soon reached when, as we saw in our last chapter, the efficient working of the suburban service requires the provision of duplicate running lines and also of extended terminal accommodation. This, in the neighbourhood of a large and growing city, involves very large expenditure and perhaps more than doubles the capitalisation of the section of railway concerned. The company is then in the position of having spent a great deal of money primarily for the accommodation of the low-fare suburban traffic, whereas originally this traffic was merely a by-product of a plant laid down for the production of a more remunerative form of transportation. Under these conditions, it is extremely doubtful whether it is really good policy for a railway company with good main-line resources to lay itself out for the accommodation of short-distance suburban customers. At the outset such traffic is undoubtedly very profitable, as it can be accommodated without additional expense beyond the running of more frequent trains within the suburban zone; but later on it may become excessively costly by necessitating the provision of lines, station accommodation, and rolling-stock which are only required within a few hours morning and evening. When, however, the special outlay for the traffic has once been incurred, a railway company feels bound to take measures to prevent the diversion of its suburban business to competitive electric tramways; and this is the reason for the sweeping reductions of fares recently made on several of the lines in London and the larger provincial cities, where the "zone" system—*i.e.*, a uniform fare within a certain distance—has been adopted by one or two of the companies.

The railway companies of the United Kingdom are primarily commercial undertakings formed with a view to the earning of dividends on invested capital. Nevertheless, they cannot divest themselves of the character of public servants, as they have been brought into being under Parliamentary authority for the purpose of doing work which is absolutely necessary to the community, and which in many countries is performed by the State itself. Therefore, railway fares and rates cannot be fixed on a crudely commercial basis. In the passenger department, Parliament has, by the Cheap Trains Acts of 1844 and 1883, made it obligatory upon the companies to provide "a due and sufficient proportion of the accommodation for passengers at fares not exceeding one penny per mile," and also to carry workmen, soldiers, sailors, policemen, etc., at an even lower rate than this. But by far the larger part of the facilities for cheap travelling which exist on our lines have been brought about by the discovery that "facilities create traffic" and that you cannot *fill* a modern railway with high-paying freight alone. You must "charge what the traffic will bear," if you are to do the largest possible amount of business and utilise your plant to the best advantage; just as a doctor cannot build up a large practice except by charging his patients according to the weight of their purses. But the medical man who, with a large mixed population at his doors, attends the poor for next to nothing, may soon find himself unable, on account of the pressure of that part of his practice, to attend properly to the requirements

SLEEPING COMPARTMENT, L. AND N. W. R.

SMOKING-SALOON ON SLEEPING-CAR TRAIN, L. AND N. W. R.

of his better-paying patients. This is a danger to which railway companies are constantly exposed; and the art which the Americans call "rail-roading," on the commercial side, consists in so adjusting the facilities offered as not merely to fill the trains, but to secure the largest possible proportion of high-paying freight and, at the same time, to provide for the reasonable requirements of the population as a whole.

The plan adopted by the founders of our railway system was to have three classes of passenger accommodation, the charges for which were supposed to be adapted to the means, and the facilities offered to meet the needs of the upper, middle, and lower classes of the population. Speed and comfort were in those days extended only to first and second-class passengers. The masses of the people were held to require, and to be able to pay for, only the slowest and the barest kind of transportation. Even first-class travel forty years ago had to be done under conditions which made it a disagreeable adjunct to business or pleasure, instead of being, as it usually is to-day, a pleasure in itself.

Undoubtedly passenger business conducted under these conditions was very profitable to the railway companies, or at least to such of them as commanded the main routes of travel. For there was a sufficient number of travellers upon whom transportation over those routes was obligatory, to fill the lines as they then existed nearly up to the limits of their passenger capacity. As early as the 'forties, however, the idea dawned upon a few enterprising men, of whom Thomas Cook and James Allport were destined to become the most famous, that there might be a "business of travel" in addition to the travel required by business, and from this idea grew that remarkable modern development—the excursion traffic of our railways, most of which is conducted on the terms of charging single fare for the double journey. One of the first excursion trains known in railway history was run on the Midland Railway from Nottingham to Leicester on August 24th, 1840, "to view the splendid alterations which have recently been made in the Leicester Exhibition." To quote a contemporary account, "the enormous train of nearly seventy carriages passed majestically in review before the astonished spectators. It was indeed a wonderful scene. Grand, magnificent, sublime, were the terms which gave vent to the feelings as in countless succession the animated mass rushed into view. It was, in truth, a moving city, with banners, music, and accompaniments, and all the material of high excitement to enhance its efficiency."

The number of people carried in this early "excursion" is stated to have been about 2,400, which is certainly a large number to be hauled in a single train. As explained in our last chapter, however, the deficiencies of the signalling and braking appliances of those days made it dangerous to divide the party. Monster modern excursions, such as Messrs. Bass's annual trip from Burton, or the yearly excursion of the Swindon *employés* of the Great

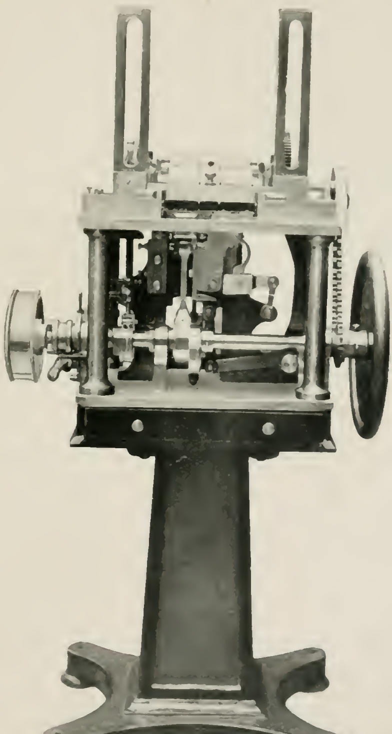
Western Railway, are differently conducted. A succession of trains is run at about ten-minute intervals, thus securing much quicker despatch. For the Bass trip of 1904, for example, no less than seventeen "specials" were chartered by the great brewing firm, and by the time the last of these had left Burton, the first had arrived at the destination of the party—Blackpool—ninety miles away.

When the Midland Railway Company opened its line to London in 1868, its general manager, Mr. James Allport, found that he must "tap new strata" if he was to obtain the requisite amount of passenger traffic for this highly competitive line. It was for the carriage of coal from the rapidly developing collieries of the Midland Counties to London that the line was primarily constructed, and passenger traffic with the Metropolis was, practically, a by-product. It could therefore, in Mr. Allport's opinion, be legitimately conducted at comparatively low fares. Hence the two successive new departures on the part of the Midland directorate which astonished the British railway world in the early 'seventies, and revolutionised passenger travel on our railways. I allude, of course, to the policy adopted by Mr. Allport of carrying third-class passengers by all trains, which was instituted in 1872, and followed three years later by the abolition of second-class carriages and the reduction of first-class fares to second-class level. These changes struck a blow at the profitableness of the passenger business of the main lines to the North, from which they have never since wholly recovered. As has already been explained, it is impossible to ascertain conclusively whether any one department of a railway company's business "pays" or is conducted at a loss; but some elaborate calculations prepared about fifteen years ago by Sir George Findlay, the then general manager of the London and North-Western, led that authority to declare that "the revenue to be derived from the conveyance of passenger traffic upon English railways was a diminished and diminishing quantity." He added: "The state of things thus described, so unfavourable from the railway shareholders' point of view, has been brought about chiefly by reason of the lengths to which the companies have gradually proceeded, under the pressure of competition, in making concessions without adequate remuneration for the privileges bestowed." Since those words were written, such concessions have been carried to still further lengths, particularly in the direction of increasing the luxury of third-class travel.

It is impossible to draw a hard and fast line between necessary and optional travelling, and to say that so many passengers will make their journeys in any case, whilst so many others require to be tempted by special facilities. Broadly speaking, however, these two classes of travellers exist, and the distinction between them should be made the foundation of all differences in passenger fares and accommodation. It is a mistake to give too much, or charge too little, to the passenger who has to go; it is equally a mistake to charge too much, or offer too little, to him who has the option of staying at home. The exigencies of the situation would appear to be best met by having a comparatively high scale of ordinary fares, coupled with the highest attainable standard of speed and comfort, and qualified by a very liberal programme of "special bookings" at a lower level of accommodation. It would also appear reasonable not to charge the same scale per mile for the longer journeys as for the shorter ones, particularly in the case of tourists. The principle which justifies a reduction of $\frac{1}{4}d.$ a mile on a return ticket should also justify a similar concession to the man who "books" for a single journey of, say, 300 miles, as compared with the 150-mile traveller. This is a principle which the Great Western Railway Company has just begun to act upon, tentatively, in connection with its traffic between London and Cornwall. The mistake made by the northern lines at the instigation of the Midland was to reduce too sweepingly their ordinary scale of fares, whilst at the same time practically destroying the distinctions between the "classes" as regards accommodation. It seems probable that by confining the changes then made to special bookings, the northern companies might have secured the advantages of the immense modern developments of pleasure travel, without rendering their business passenger traffic unremunerative, as it is to be feared they have done.

In addition to the supreme problem of fixing the fares, there are many minor problems which come up for solution in the passenger department of a great railway. One of these is the supply of tickets. Twelve hundred million passenger journeys made over the railways of the United Kingdom imply the issue of twelve hundred million separate pieces of pasteboard. Allowing for "returns" and for the journeys of season-ticket holders, perhaps the number of ordinary tickets issued does not exceed eleven hundred millions annually; but whatever the approximate number may be, it is obvious that the printing, issuing, and collecting of them involves a great deal of work upon the responsible officials. There is need, too, of the most systematic organisation and the most careful arrangement of check and countercheck, for countless are the opportunities of fraud which present themselves both to travellers and *employés* in connection with railway tickets.

Some British railway companies print their own tickets; others contract for their supply with firms such as Waterlow & Sons, Limited, who have made a speciality of this class of work; others print some themselves and contract for the rest. This last is the case with the Great Northern Railway Company, at whose stationery stores at Holloway I was recently permitted to see the ticket-printing machinery in operation. A ticket-printer, in appearance, is something like a penny-in-the-slot automatic machine for the supply of sweetmeats. In one column the blank cards are placed. When the machine is set going, the column of cards gradually falls, and a column of tickets rises in a similar receptacle on the other side of the machine. The ordinary type of



A RAILWAY TICKET-PRINTING MACHINE.

Photo by Waterlow & Sons, Ltd.]

machine prints the cards on one side only, and they have to go through a second process before they are complete. But there is a still cleverer type which takes the tickets as they come down the columns, prints them on the one side, turns them over, and then prints them on the other side. In either case the printing on the name side of the ticket also includes numbering with successive numerals, beginning—for each batch—at 000 and closing at 9999. The part of the machinery which performs this last-named operation is somewhat similar to a typewriter, except that it operates automatically.

The successive numbering of the tickets, and their subsequent dating in the press before being passed through the window by the booking-clerk, are important safeguards against fraud. To this end it is most necessary to exercise the utmost care lest tickets should be printed with duplicate numbers, and also that no one of a series should be missing. Immediately after being printed, the tickets are, therefore, passed through an ingenious counting-machine, which automatically records on a dial the number which has passed through it. 250 tickets at a time are counted by this machine; and should the dial not record exactly that number at the close of the counting process, a most careful search has to be made, so that the duplicate may be destroyed or the missing one supplied.

The number of different tickets issued by a large railway company is legion, and it is impossible to keep a supply of every kind in stock. Much ingenuity has been expended upon the invention of differently marked and coloured cards to denote tickets of various classes ; and provided a supply of the right kind of card is ready to hand, it is a matter of but an hour or so for the printer to set the requisite type, place it in the machine, adjust the numbering apparatus, and set the automatic mechanism to work. In a very short time some hundreds or thousands of the required class of ticket can be produced, and consequently the business of supplying the booking-clerks is usually conducted on a "hand-to-mouth" basis. But, of course, it is the duty of the officials in charge of the booking-offices to see to it that they do not entirely exhaust their stock of any one kind before sending a requisition to the stationery stores for a fresh supply. It is rather curious that in the summer time, when the holiday traffic is at its height, the amount of the requisitions received at the stores is usually less than at other times of the year. The explanation is that in the rush of the summer business the booking-clerks have no time to overhaul and renew their stocks. This is done at the slacker times of the year, and a generous supply is thus got in hand in preparation for the holiday pressure.

When a booking-clerk is "caught short" on a particular line of tickets, he usually falls back upon the closing numbers of the kind most nearly resembling those he is lacking. But whenever he does this, he has to send a special advice to the audit-office at headquarters. For cases of emergencies, and to meet the exigencies of exceptional bookings, various kinds of blank forms are supplied.

A few years ago it would probably have been correct to say that all railway tickets issued on the railways of the United Kingdom were collected at, or near, the end of the passengers' journeys. With the opening of the Central London Railway, however, the innovation was introduced of collecting the pasteboards before the passenger entered the train. Could such a practice be adopted generally, it would not only obviate the "lost ticket worry"—*vide* the "Twopenny Tube" advertisements—but it would also be an important safeguard against fraud; but, of course, the Central London system is only possible with a uniform fare. The competition of railway companies with one another, and their eagerness to create traffic by offering exceptional facilities, have produced the most complicated and bewildering varieties of fares and conditions of journey, with the corresponding necessity for the creation of a vast number of different classes of tickets. The most troublesome of these to the railway authorities are those which are available for more than one journey, such as "returns," "seasons" (or "contracts," as they are called in the North), and "tourist" and "circular" tickets. As already stated, the best preventive of fraud is to compel each passenger to give up a ticket before he enters the train, as is done by the Central London. The next best method is to make him show the ticket on entering the station and give it up on leaving, and this is, of course, the practice with all ordinary tickets. But in the case of many special forms of ticket the rule cannot be enforced. The fact that by uttering the magic word "Season!" a ticketless person can usually pass the barrier at many busy stations, is a standing encouragement to the unscrupulous to defraud the railway companies, which is only partially checked by the practice of making periodical examination of "All seasons!" The issue of books of daily tickets in place of cardboard "seasons" has been adopted on the Central London, and it would appear to have much to recommend it as a safeguard against fraud, provided due precautions are taken against forgery. The authorities of the Metropolitan District Company are now considering the adoption of the same system. As regards "returns," the companies have hitherto endeavoured to check misuse by limiting the availability of the return half within a few days of issue; but, on the initiative of the London and North-Western, the limit has recently been extended to six months, thus putting ordinary "returns" practically on the same level as "tourists," the return halves of which have for many years been available for two months, and in some cases for six months, after the date of issue. Were it not for the pressure of competition and the desire of each company to attach a traveller to its route for his return journey, the issue of "returns" might well be abolished, and its place taken by a system of graduated fares, giving an increasing advantage to the long-distance traveller, such as the Great Western has lately introduced for

THE QUEEN'S DAY-SALOON, L. AND N. W. R.

THIRD-CLASS DINING-CAR, EAST COAST JOINT STOCK, G. N., N. E., AND N. B. R.

its Cornish traffic. The same principle has been adopted on the North-Eastern and one or two other lines, in the form of the issue at a discount of books of coupons entitling the holder to travel 1,000 miles within a fixed period of time.

The life of a railway ticket does not end with its collection at the station barrier. In company with its fellows collected at the same station, it is carefully packed up and sent off without delay to the audit-office at headquarters, where there is a large room and a considerable staff devoted to ticket-sorting. High railway officials have begun their career as boys in the ticket-sorting room, where they learnt to know the geography of the line from the names on the pasteboards. Some of the companies now employ girls for the task, as being defter and more methodical. In this office every collected ticket is sorted into its proper series, and the delinquencies of booking-clerks and collectors are brought home to them by means of the reports periodically made by the audit accountant to the superintendent of the line as to numbers missing or irregularly issued. Frauds on the part of travellers, too, are often detected by the vigilance of the ticket-sorters. A common thing is to find that a number of short-journey tickets are being issued but not collected. Investigation may point to the conclusion that a dishonest traveller is in the habit of taking a ticket merely from one station to the next. Having passed the barrier at his departure station by this means, he continues his journey to his real place of destination, where laxity on the part of the collector, or the supposition that he is a season-ticket holder, enables him to pass out without challenge. After the tickets have been sorted, they are destroyed by a cutting machine specially provided for the purpose, and their remains are sent to the paper-makers, to be worked up into fresh cards. Printed tickets cost railway companies from 1*s.* 3*d.* to 1*s.* 6*d.* a thousand, and about a million of them weigh a ton.

The original intention of our railway companies was merely to provide the track and the motive power for the haulage of vehicles belonging to their customers. In the goods traffic department this policy still partially prevails, there being about half a million traders' wagons running on the lines. In the passenger department, privately owned carriages are practically extinct, even the Royal saloons being the property of the companies. The new Royal train recently built by the London and North-Western Railway Company at its carriage works at Wolverton represents the highest perfection yet attained in the railway carriage builders' art. It consists of the King's car, the Queen's car, and six others for the accommodation of their suites. The two cars first named are, of course, specially reserved for their Majesties' use, and are not infrequently lent to other railway companies for Royal journeys; but the cars built for the Royal suites can, at a moderate charge, be secured by ordinary travellers on giving sufficient notice. It may possibly surprise some readers to learn that when His Majesty the King

RAILWAY CARRIAGE-ERECTING SHOP, WOLVERTON CARRIAGE WORKS, L. AND N. W. R.

and the members of the Royal Family travel by rail, they pay for their journeys like other folk.

Shortly after the Midland Railway Company abolished second-class carriages on its line, it introduced into this country the American "Pullman" car, a number of which are still running on the Brighton, South-Western, and other lines, on hire from the Pullman Car Company. The companies respectively forming the three main routes between London and Scotland have a number of jointly owned passenger coaches. With a few exceptions such as these, the passenger rolling-stock of each of our railway companies is exclusively its own property, save, of course, when a large company undertakes to work the traffic of a smaller line. The running of "through" coaches from one line to another is also quite common, the earnings of these being distributed through the Railway Clearing House, as already explained.

Most of our larger railway companies build and repair their own passenger carriages. The carriage department is usually a branch of the establishment presided over by the chief mechanical engineer; but in several cases its organisation and location are quite separate from the locomotive works. The passenger stock is commonly classified as "firsts," "seconds," "thirds," "composites" (*i.e.*, carriages comprising more than one class of compartment), saloons, and brake-vans. There are, however, many varieties of each of these classes, such as lavatory and corridor-cars, "diners," "sleepers," family-saloons, picnic-saloons, invalid-carriages, etc. The pattern-book at Wolverton, for instance, shows nearly a hundred different designs. The head of the carriage department has, of course, to work to the requirements of the superintendent of the line and his staff, who, under the supervision of the general manager and the Board, settle what additions are to be made to the stock from time to time. Much of the regular traffic of the line is done in "block" or "linked" trains—*i.e.*, trains the cars of which are never uncoupled, from the time they come out of the works until they go in again for repair or renewal. On the other hand, a large proportion of the passenger stock is "loose"—*i.e.*, it is constantly being uncoupled and coupled up again in trains of varying "make-up" to suit the traffic requirements. Usually there is an official with the title of "rolling-stock controller," located at some central point of the system, whose duty it is to regulate the movements of the cars and see that the spare stock is kept in the right places to meet the varying requirements of the traffic. On Bank Holidays and other specially busy days this official is often hard pressed to supply sufficient carriages for the trains which the superintendent of the line wishes to run, and he has to exercise much ingenuity in arranging "duplicate" and "triplicate" workings for his coaches. Sometimes he is able to borrow stock from a neighbouring company.

The working of all regular passenger trains has to be so arranged as to secure a "circuit" for the

VACUUM-CLEANER IN USE FOR RAILWAY CARRIAGES, G. N. R.

CARRIAGE-WASHING AT WOLVERTON WORKS, L. AND N. W. R.

carriages—*i.e.*, that they may return to their point of departure either the same day or the day after. The carriage-sheds, where the stock is stabled when not in use, are situated at various convenient points in the neighbourhood of terminal or other important stations, and are under the control of the carriage superintendent, who is responsible for keeping every vehicle clean and in good repair. Special appliances are provided for washing and removing dust from the cars, the latest device for the latter being the "vacuum cleaner," an apparatus for removing dust by suction through a hose. This machine is usually lodged in a van which travels from place to place. For cleaning exteriors, a special washing-machine is employed by some companies, whereby brushes are thrown into contact with the carriages as they pass through a special structure, whilst spraying pipes turn on to them a strong stream of water. Other carriage superintendents prefer ordinary manual washing, with the assistance of a trough of water running alongside the stand of the cars. The carriage superintendent has a staff of inspectors distributed over the more important stations on the system who examine axles, tyres, etc., during the ordinary station "stops." The "tapping" noise made by these men is a familiar sound to all railway travellers.

The lighting and heating of the carriages are two of the most perplexing problems of the passenger department. For many years the oil-lamp and the hot-water-can were the primitive appliances exclusively employed, and as these had to be renewed at all important stations, they added very considerably to the work of the traffic staff and were frequently the cause of unpunctuality as well as of discomfort. The use of electricity generated from the axle for illuminating, and of exhaust steam carried through a pipe from the engine for heating, has removed both these matters out of the sphere of the traffic department and placed them in the hands of the locomotive and carriage superintendents, to the great advantage of all concerned. Where oil-gas is used for lighting, the gas-holders carried under the cars have constantly to be recharged, and as this cannot always be done in the carriage-sheds, it devolves, in some places, upon the station staff. Electric lighting from the axle, on the other hand, is practically automatic, as, by an ingenious contrivance known as "the slipping of the belt," the pressure and output are kept steady and constant in spite of the very varying speeds of the train. Each coach, moreover, is self-contained when equipped with its own dynamo and accumulators. The system of heating cars by steam from the engine is not so completely satisfactory, proper regulation being the chief difficulty, and complaints of overheating are common. Both in the steam-pipes and in the old-fashioned foot-warmers, acetate of soda is used for the better retention of the heat.

Just as improved signalling and braking appliances conduce to better working of the lines, so also do additions to the comfort of railway passengers. But

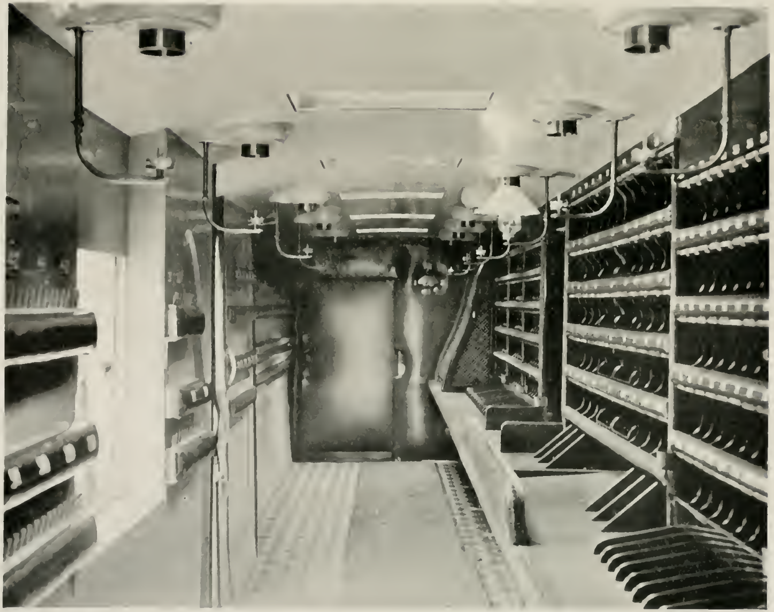
MAIL-VAN, SHOWING NET AND VESTIBULE CONNECTION, L. AND N. W. R.
The net is used in connection with the apparatus shown below.

APPARATUS FOR RECEIVING AND DELIVERING MAIL-BAGS TO AND FROM A TRAIN IN MOTION.
The bag drops into an elastic net carefully adjusted to take off the force of the impact.

for the skill of carriage superintendents in designing trains which afford lavatory and refreshment accommodation to every passenger, it would be impossible to make those long non-stop runs which are so important a feature of present-day "railroading" in the passenger department. The result is that long-journey passengers are transported with far greater expedition than in the more leisurely days when a stop of half an hour to an hour for dinner was quite a common arrangement. The efficient and economical working of the whole plant must in the long run be enhanced thereby, though during the transition stage some loss is inevitable from the supersession of accommodation provided to suit different conditions of travel at the large "stopping" stations of former days. From the shareholders' point of view there is, as already suggested, reason to regret that the companies, under stress of competition, have, whilst so greatly enhancing the comfort and convenience of railway travelling, not maintained a scale of fares commensurate with the increased expense involved; nor are the charges made on trains for meals and sleeping accommodation usually fixed at rates likely to be profitable, having regard to the very special difficulties of the services rendered.

The carriage of the mails is a branch of the work of the passenger department which deserves a special chapter to itself. Here it is not possible to do more than note that every effort is made to promote despatch, by the provision of travelling sorting-offices, and by means of the ingenious appliance which is illustrated herewith, for taking on board and dropping mail-bags when the train is running at speed. The mail-bag to be delivered to the travelling post-office carriage whilst the train is speeding by is wrapped in a strong leather pouch, which is suspended by a strap from an iron post. As the train rushes up, the operator in the sorting-carriage pulls a lever which extends a net outside the carriage; a projection therefrom knocks the strap of the suspended bag, which at once falls into the net. The bag is at once opened, a staff of sorters quickly deal with the letters, which are re-sorted into bags, to be despatched at the subsequent "apparatus" or "stopping" stations. Similarly a bag dropped from a train in motion is suspended by a strap outside the sorting-carriage; the strap comes in contact with an arm extending from the apparatus-post on the railway; the bag is immediately released and drops into an elastic net carefully adjusted to take off the force of impact.

In our last chapter this arrangement was compared to the somewhat similar one for exchanging the "staff" in single-line working without stopping the train. Reference may also be made in this connection to the method—commoner, perhaps, ten or twenty years ago than it is to-day—of setting down passengers at an intermediate station by means of a coach "slipped" from the tail of a passing express. This is effected by means of a hinge on the coupling-hook of the car which it is desired to "slip." This



INTERIOR OF TRAVELLING POST-OFFICE, L. AND N. W. R.

hinge is supported by a pin, which, in its turn, is connected with a lever in the guard's van. The pulling over of the lever withdraws the pin, thus causing the hinged hook to drop and the coupling to be released.

CHAPTER VIII.

The Commissariat.

IT was, I believe, the great Napoleon who said that an army moves on its stomach, meaning thereby that the distance it can cover depends upon the efficiency of its commissariat. The same principle applies to the journeys of peaceful travellers, and therefore the business of providing food and drink is closely associated with that of transportation. Stage-coaching was intimately allied with innkeeping; and every proprietor of a passenger vessel is of necessity also a caterer, unless it be merely a ferry-boat, or a pleasure-ship the cruises of which are limited to an hour or two. A railway train crossing a great continent resembles an ocean-going vessel in being a travelling hotel; but the two small islands of which the United Kingdom consists provide no continuous railway journeys longer than can be accomplished in a single day or night. Therefore the term "travelling hotel" cannot be appropriately applied to any train running on British or Irish railways, for our railway companies are not called upon to make provision in the same set of coaches for both day and night journeying.

FIRST-CLASS DINING-CAR, L. AND N. W. R.

THIRD-CLASS DINING-CAR, L. AND N. W R..

In the United Kingdom the long-distance traveller by day is provided with conveniences for taking all his meals on board, and the night passenger is provided with a comfortable bed, and with such light refreshments as he requires between dinner and breakfast. The task of the commissariat of our railways is to that extent simpler than on Continental lines; but, on the other hand, the provision of meals for shorter-journey passengers is carried on more extensively, and more perfectly, in the United Kingdom than on the railways of any other country, besides which our railway companies stand in the unique position of being themselves large hotel proprietors. This involves so heavy an addition to the work of the commissariat departments of the leading lines as to place the importance of this branch of our railway service far above the corresponding section of any other railway administration in the world.

Some difference of opinion prevails amongst the railway authorities of the United Kingdom as to the place which should be occupied by the commissariat department in the polity of their undertakings. The more generally accepted view is that it is the business of railway companies, in carrying on their hotels and refreshment-rooms, to cater only for actual or potential passengers. Their object in undertaking commissariat (according to this view) is to encourage travel on their lines by filling up gaps in the general catering enterprise—where the absence of facilities for obtaining food or lodging is prejudicially affecting the traffic of their railways—but not to compete with other caterers or hotel-keepers, where the public is sufficiently well cared for without their intervention. Others, however, hold that, theoretically sound though these limitations may be, it is commercially impossible to keep within them. These authorities take their stand on that axiom of modern business competition, that "there is always most room at the top." If a railway company is to succeed with its hotels, say they, it must conduct them on the most go-ahead lines and offer the greatest possible combination of attractions.

Looked at from a practical point of view, the commissariat department of a railway cannot be separated from the traffic department, any more than a steamship company can be expected to carry on its catering business separately from its general trade. Something must be debited to the exigencies of competition, something more to advertisement; and it would puzzle the directors and general managers themselves to say in some cases whether a certain expenditure had been justified or not. Broadly speaking, the commissariat department is not expected to contribute to the dividend; but, on the other hand, many of its branches do pay, and that handsomely, whilst others are, no doubt, carried on at a loss.

The simplest way for a railway company to provide refreshments for its passengers is to let the work out to a firm of caterers, such as Messrs. Spiers and Pond or Bertram and Co. This was very generally done in the early days of railway enterprise, and it is still the practice of the lines running southwards from London, of the North British (in part), and of a number of the smaller companies. In such cases the railway company usually provides the permanent structures, be they refreshment-rooms or hotels, on the basis of receiving rent from the contractors in the form of a fixed percentage of the gross takings; but the agreement recently made between Messrs. Lyons and the London, Chatham and Dover is on the basis of profit-sharing rather than tenancy. In the case of the London and South-Western, Messrs. Spiers and Pond have a lease of the catering for the dining and luncheon-cars as well as the refreshment-rooms, but the fine hotel at Southampton is managed by the railway authorities themselves, who also do their own catering on their steamboats. By a leasing arrangement a railway company is saved from the risks incidental to the catering business, whilst it retains, by the terms of the lease, some control over both the prices and quality of the provisions supplied. On the other hand, a profit has to be earned by the caterers over and above the gain accruing to the railway authorities. The competition in facilities which is so important a factor in British railway working—competition in rates having been abandoned by mutual agreement—tends to make the commissariat a branch of the advertising department, in the sense that the line with the best reputation for looking after the creature comforts of its customers gets "a pull" over its competitors. This is the main reason why, where competition is most keen—*e.g.*, in the case of the lines running northwards from London—we find all the companies doing their own catering. Whether it pays or not is a secondary consideration. The main thing is that the standard of comfort must be high.

Excellence in the commissariat department not only diverts traffic from a rival route, but it also creates business for a non-competitive railway. At a very urgent summons a man will travel hundreds of miles without food, or will content himself with "battening on buns"; but a very large proportion of the travel over our railways is of choice rather than of necessity; and the fact that one can breakfast, lunch, or dine on the train often turns the scale in favour of going oneself instead of trusting to correspondence to achieve the end desired. Thus it is that the restaurant-car, first adopted on competitive routes in order to "steal a march" upon a rival railway, is now coming into general vogue on all long-distance trains, the Great Western and the South-Western—much of whose traffic is non-competitive—having recently followed the lead of the northern companies in providing accommodation for taking meals *en route*, whilst northern lines like the North-Eastern, who have the monopoly of certain districts, do not confine their restaurant-car trains to competitive routes.

A good example of a railway company which has been quick to recognise the traffic-making power of the restaurant-car is the Great Eastern. In the case of the Harwich Boat Expresses—which are amongst the finest dining-trains in the United Kingdom—competition with other routes to the Continent is no doubt the predominant factor; but the restaurant-cars on the Yarmouth, Lowestoft, Norwich, and Cromer services—which allow a passenger to breakfast on the "up" and dine on the "down" journey—are genuine traffic-developers, the more praiseworthy because the towns thus linked with the Metropolis are not comparable in importance with those to serve which the restaurant-cars of most of the other lines have been put on. Even little Clacton-on-Sea has its weekly "supper-train" on Saturday night, enabling Clactonians to visit the London theatres, and theatrical folk to spend the Sunday at "Sunny Clacton." In this connection a word of praise should also be given to the Irish railway companies, who have shown the same kind of enterprise on comparatively thinly populated routes. They have done wonders, too, in improving the hotel accommodation of Ireland—once a byword, but now the theme of praise, amongst tourists.

The introduction of dining-cars on the railways of the United Kingdom dates from November, 1879, when the Great Northern introduced on its London-Leeds service the first vehicle of the kind seen in this country — thereby "going one better" than the Midland, which had imported "Pullmans" from America five years earlier, with "drawing-room" and sleeping accommodation, but equipped for serving only the lightest of refreshments. The Midland followed suit by putting dining-cars on its London-Leeds service in 1882; and shortly afterwards the London and North-Western, Midland, and Great Northern all introduced similar accommodation on their London-Manchester services. The 5.45 p.m. out of King's Cross is the lineal descendant of the first dining-car train run in this country.

As the journey between London and Leeds or Manchester occupies less than half the time taken between the Metropolis and Glasgow or Edinburgh, one might have supposed the Anglo-Scotch services would have been the first to receive the convenience of dining *en route*. That the adoption of restaurant-cars on the three main routes between London and Scotland did not take place until 1893, and that even after that date, for a number of years, some of the principal trains ran without such accommodation, is attributable to the "vested interests" of the refreshment-rooms at Preston, York, and Normanton, respectively, where, ever since the openings of these several routes, travellers had been allowed time to take midday dinner before resuming the journey. I do not mean "vested interest" in the same literal sense as had to be overcome by the Great Western at Swindon, where an agreement had been made with a catering company to stop all trains for at least ten minutes for refreshments, the term of the arrangement being for ninety-nine years from 1842. At the end of fifty years the Great Western authorities found this compulsory stopping an intolerable obstruction to their long-distance traffic,

THIRD-CLASS DINING-CAR, GREAT NORTHERN RAILWAY.

INTERIOR OF KITCHEN-CAR, GREAT NORTHERN RAILWAY.
Photo by C. Pilkington.]

and accordingly in 1895, they bought out the Swindon Junction Hotel Co., the price paid being a refund of its original capital—£100,000.

No such extravagant arrangement had been made by any of the northern lines, but they had invested considerable sums in very spacious dining-rooms at the stations I have mentioned, and they were naturally reluctant to throw these to a large extent out of use by introducing dinner on the train. Moreover, a meal hurriedly taken during a compulsory stop of twenty minutes or half an hour is a much more profitable thing to the caterer than one enjoyed at leisure in a well-appointed restaurant-car. In one case the passenger is usually only too glad to spend as much time as possible over his eating and drinking; in the other, an over-hasty attempt to swallow a basin of hot soup—the invariable commencement of these platform meals—often put a hungry traveller out of action so far as the rest of the *menu* was concerned; or if he, or she, did at length get settled down to something more solid, the clang of the porter's bell, and the hoarse cry of "Take your seats, please!" from the guard, prevented all but the most experienced from doing anything like justice to the viands. Thus it was decidedly a self-denying ordinance to the commissariat departments of certain of the companies when the fiat went forth that the twenty or thirty minutes' stop at York or Normanton or Preston was to become a thing of the past, and that the meals required by the through Anglo-Scotch passengers were in future to be provided in restaurant-cars. These were the first dining-saloons to be provided for the third-class penny-a-mile passengers.

The provision of restaurant accommodation for all classes of passengers was greatly facilitated by the invention of the corridor train—a type of railway rolling-stock which originated in this country, and which is gradually coming into universal use amongst us for long journeys, whereas the American "Pullman" has withered on British soil. Even the Midland authorities have now been converted to faith in the "corridor." Thanks to this and the vestibule connection between the cars, the use of the restaurant-car on some of the longer routes nearly resembles that of a dining-saloon on a vessel. Passengers book their places for meals at specified times, and at the appointed hour they are conducted by an attendant along the corridor to the restaurant-car, which they vacate as soon as their meal is finished, in favour of the next batch of hungry customers. But, of course, such an arrangement is only possible on a long journey, and when the majority of the passengers are going "through." Given those conditions, it is, to my mind, a much better plan than allowing passengers to take seats in the "car" at the start of the journey. It is, no doubt, possible to pack more people into the train under the latter arrangement, but the former permits a larger number to be fed in comfort, and with a smaller plant and staff.

Where the distances are shorter—and the practice of putting restaurant-cars on comparatively short-distance trains is increasing every year—it is often necessary to provide accommodation for feeding a large number of passengers simultaneously. This is the case on the Harwich Boat Express, which leaves Liverpool Street at 8.30 every evening, and returns from Parkeston Quay at 6.30 the next morning. The "down" journey occupies one hour and twenty-five minutes, and the "up" journey an hour and a half, so that there is barely sufficient time to serve two relays of meals. Accordingly, the train is arranged with table accommodation for no less than a hundred and eleven passengers at one time—forty-seven in the first-class, and sixty-four in the second. Dinners or breakfasts for all these people are served simultaneously from a kitchen seventeen feet long and six feet six inches broad, placed in the centre of the middle car of the three composing the restaurant section of the train. Similarly the London and South-Western on its West of England restaurant-trains can feed seventy-seven passengers simultaneously—*viz.*, twenty-four first-class, twenty-two second-class, and thirty-one third-class—all the meals being served from a single centre kitchen.

To the uninitiated it seems wonderful that these little travelling kitchens, manned by a single *chef* with one assistant, can turn out the amount of work they do. It is no uncommon thing for one hundred meals to be served simultaneously from a single kitchen, and the Great Eastern have a "record" of 226 breakfasts provided for a "beanfeast" party, the restaurant-car equipment being similar to that of the Harwich Boat Express above described, and the passengers being served in two relays.

Generally speaking, the restaurant-trains of the leading lines provide for the simultaneous feeding of fifty or sixty people in the proportion of one-third first-class and two-thirds "third" (or "second" and "third.") The first-class car is generally a "composite," and contains the kitchen, being connected at that end with the other car, which is entirely devoted to the accommodation of the lower class or classes. As already explained, the aim of the commissariat department, where the traffic is competitive, is to make the catering a "draw" by doing everything in the best style. If this high standard is to be maintained, it is not desirable to serve more than sixty passengers at once; otherwise the food gets cold before it reaches those seated farthest from the kitchen. Moreover, the attendants—usually limited to two, or at most three, for each car—have their work cut out to get the meal through within the time allotted, a five-course dinner having, in some cases, to be served within the space of less than three-quarters of an hour—*i.e.*, the time occupied in the run between two important stopping-stations. And not only must the meal be got through, but—a most important matter—the bills must be made out and collected, which is no light task for the head attendant. In the bustle of alighting at their destination, not a few passengers would get out without paying for their meal, unless respectfully reminded of their

KITCHEN OF DINING-CAR DEPOT, EUSTON STATION, L. AND N. W. R.

Photo by C. Pilkington.]

LINEN-ROOM OF DINING-CAR DEPOT, EUSTON STATION, L. AND N. W. R.

Photo by C. Pilkington.]

debt, whilst there are others who would not scruple to evade payment were the attendant not on the alert to collect all dues as the train slows down.

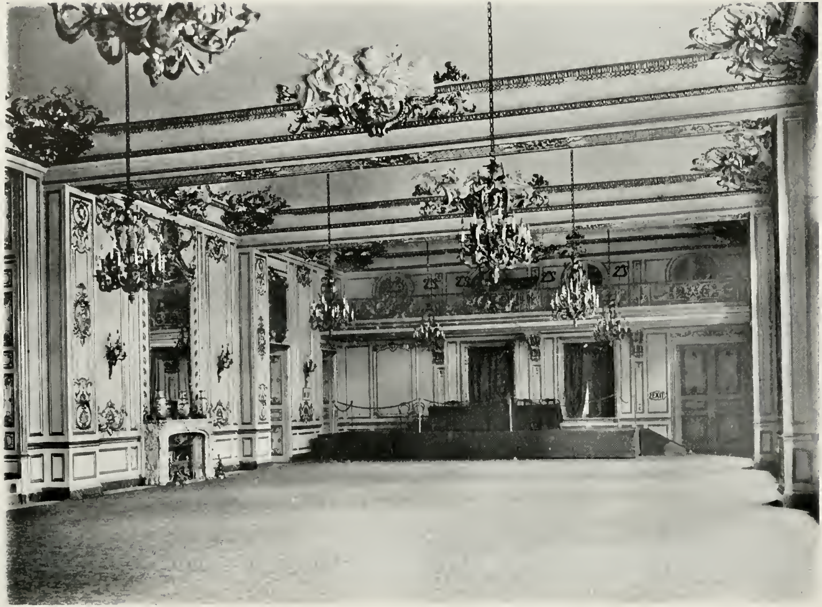
No less alertness, though of a different kind, is required of the *chef* in the kitchen. A man of method is he, scrupulously clean and orderly, and with an expert eye to measure his supplies, so that an unexpected demand may not find him unprepared. On the primitive dining-cars, coal-fires were used in the travelling kitchens, but now gas-stoves are the universal rule, the supply of compressed oil-gas being carried in a cylinder under the floor of the car. Formerly the same kind of gas was generally employed also for the lighting of restaurant-cars, but this has lately been largely superseded by electric light, generated from the axle of the vehicle, as described in the last chapter. Even in the kitchens, electric light is now common ; and in the more modern cars, very special attention is paid to ventilation, thereby greatly improving the lot of the *chefs*, who in the older vehicles suffered considerably from heat and want of air. Generally the stove is placed transversely across the car, but in the latest Midland design its position is longitudinal, with the corridor behind it. This affords greater width for the culinary operations, whilst allowing for a free passage past the kitchen. On the restaurant-cars of the London and North-Western Railway Company, including the West Coast Joint vehicles (in which the Caledonian is partner with the North-Western), over half-a-million meals are served annually—breakfasts, luncheons, dinners, and teas.

The greater part of the food consumed on restaurant-cars is cooked in the travelling kitchens, joints and poultry being roasted or boiled, chops cut off and grilled, vegetables prepared, and fish boiled or fried whilst the train is running at sixty miles an hour. This fact is a striking tribute to the smoothness of British railway running, but, of course, the trains oscillate a good deal when crossing complicated junctions or descending steep gradients. Under such circumstances the frying or boiling of fish presents no small difficulty, on account of the liability of the boiling water or fat to spill. The one *chef*, too, has to pass repeatedly from the cooking of fish to meat and vegetables, and *vice versâ*, and he must be most careful to wash his hands each time, so that the flavours may not become mixed. Taking all the conditions into account, it is wonderful what perfection of cooking is attained.

Soup, pastry, and sweets generally are made beforehand, and here comes in one of the advantages of railway companies being also hotel proprietors at their principal stations, the hotel kitchens being available for the pre-preparation of the meals served on the trains. In the case, however, of two of the companies—the North-Western and Great Northern, whose London hotels are not quite so close to the platforms as those at St. Pancras, Liverpool Street, and Paddington—it has been found necessary to provide special depôts at the London termini for the restaurant-car business, the one at King's Cross being under a portion of the main departure platform, whilst the Euston depôt is an overhead building overlooking the departure side of that station. Both these depôts comprise kitchens, larders, and store-rooms of various kinds, as well as offices for the bookkeepers, storekeepers, and other clerks employed in connection with the travelling restaurants. When luncheon or dinner has to be served immediately after the departure of the train from London, the food is all cooked in these platform kitchens, and all the *chef* on the car has to do is to "dish it up," to use the phrase commonly employed in the home circle. The store-rooms of these depôts overflow with groceries, crockery, linen, and many other articles for the supply both of the cars and the refreshment-rooms. The Lancashire and Yorkshire has a similar depôt at its Exchange Station, Liverpool; for, although the company has an excellent hotel there, its manager of hotels and refreshment-rooms finds it better to keep the working of the two branches of his department separate as far as possible. On many railways, however, the hotels are used as "feeders" for both refreshment-rooms and restaurant-cars, and there is often a large bakery attached to one or more of the hotels, from which bread is supplied thoughout the system. At Liverpool Street Hotel the Great Eastern bakes not only bread, but pastry, for the refreshment-rooms down the line, the supply being despatched every morning by the newspaper-trains. The North-Western bakes at

Rugby, and the Great Northern at Peterborough, for both bread and pastry, whilst the former has also a fancy-bread bakery at Euston Hotel, which has the reputation for turning out the best Vienna rolls in London. The Lancashire and Yorkshire used to bake for itself, but has abandoned the practice as uneconomical on a comparatively short railway.

An important feature of British railway commissariat is the supply of luncheon-, dinner-, and tea-baskets to passengers on trains to which restaurant-cars are not attached. Prior to the introduction of such cars on the London and South-Western, no less than 60,000 luncheon-baskets were sold annually by Messrs. Spiers and Pond on that railway alone, and the number is still very large. The meals thus served may seem somewhat dear as compared with those taken on the cars; but the immense wastage inevitable with baskets must be taken into account—not of food, but of crockery, knives, glasses, cruets, etc. Many passengers are extremely careless as to replacing such articles in the baskets after use, while the opportunities for dishonesty are many and obvious. Another typical British feature in connection with railway refreshments is the tea-wagon, the advent of which under the carriage window brings solace to the many nervous travellers who shrink from that hurried plunge into the refreshment-room and out again, in which other travellers—I am not now speaking specially of the *bonâ-fide* variety—seem to find actual delight. In this connection a word of praise must be given to the cosy tea-rooms instituted



HAMILTON HALL, LIVERPOOL STREET HOTEL, LONDON, G. E. R.

LUNCHEON-BASKET, L. AND N. W. R.

TEA-WAGON, L. AND N. W. R.

Photo by C. Pilkington.]

STORE-ROOM OF DINING-CAR DEPOT, EUSTON STATION, LONDON, L. AND N. W. R.

Photo by C. Pilkington.]

within recent years at many large stations for the accommodation of ladies and others, thereby enabling these to escape the atmosphere of alcohol in which the aforesaid *bonâ-fide* traveller revels; nor should approval be withheld from the action of the North-Western and other railways in reducing the price of a cup of tea to *2d.* in their second and third-class rooms, thus making "the cup that cheers" as cheap as a glass of beer and cheaper than spirits. The North-Western also has a most praiseworthy rule that *employés* of the company may go into the lower class rooms and get a cup of tea for a penny. By the way, all the barmaids employed on this system are daughters or other relatives of the male servants of the company.

The provision of hotels by railway companies in the United Kingdom dates from very early in their history, and the total number thus owned at the present time cannot be far short of one hundred, including the most complete hotel in Europe, the Midland at Manchester; the largest in Scotland, the North British Station Hotel, Edinburgh; and the largest in Ireland, the Slieve Donard at Newcastle, co. Down; the last-named belonging to the little Belfast and County Down Railway Company. In London, the Midland "Grand" and the Great Eastern "Liverpool Street" stand well up in the list for size in a city of mammoth hostelries, whilst for comfort all the terminal hotels of the Metropolis have high reputations, notably the Euston and the Great Northern. By reason of its fine halls, the Cannon

Street Hotel of the South-Eastern Railway Company has long been a favourite *locale* for company meetings and other important "City" gatherings, as well as for dinners, concerts, dances, and social functions generally. A bold bid for the same kind of business has recently been made by the Great Eastern in respect of the "Hamilton Hall" and "Abercorn Rooms" recently added to the Liverpool Street Hotel. This splendid suite of apartments includes a Masonic Temple, elaborately decorated in Egyptian style. The immediate vicinity of a great railway station is a most convenient place for gatherings of all kinds, and the Liverpool Street Hotel has the advantage of being served by no less than three railways—the Great Eastern, North London, and Metropolitan.

In connection with the construction or enlargement of their stations in great cities, railway companies come into possession of central sites of unique character, upon which there is commonly room for the erection of a good deal more than premises for the reception and despatch of trains. The temptation to add a hotel to the plans is obvious, and it is not often resisted. Additional Parliamentary powers have, of course, to be obtained, but the Legislature regards hotel-keeping by railway companies as being in the public interest, and undoubtedly this opinion is borne out by results. Whether it is always in the shareholders' interests is another question, and one which, as before explained, it is impossible to decide conclusively; but that an additional stimulus is given

WINTER GARDEN AND GRILL-ROOM MIDLAND HOTEL, MANCHESTER.

Photo by Lafayette, Ltd., Manchester.]

AMERICAN BAR, MIDLAND HOTEL, MANCHESTER.

Photo by Lafayette, Ltd., Manchester.]

both to travel and to commerce by the existence of well-appointed railway hotels goes without saying. It is estimated that during last year some 40,000 people slept at the "Midland" at Manchester, who would not otherwise have spent a night in that city. They were attracted thither by the unrivalled combination of attractions offered by that hotel—a combination which must be seen to be believed, and which is but faintly depicted in two of the illustrations to this chapter. In addition to attaching visitors to the town, and prolonging and increasing the visits of buyers of Manchester goods, the hotel has supplied a real social want of the residents in Manchester and district,—forming, as it does, a refined and almost extravagantly beautiful centre for the multifarious social activities of a population much of whose daily life is necessarily spent in surroundings which are sordid by contrast.

The "Midland" at Manchester is unlike any other hotel in England at the present time, and the ramifications of its business are bewildering. The following are some statistics contributed by the company's hotels manager, Mr. Towle, to a recent issue of the *Manchester Guardian* (December, 1904):—

We have a staff of 380 servants, and pay £24,000 a year in wages. We serve 400 meals in the grill-room every day, and 500 meals in the French restaurant—these latter at an average of 10*s*. per head—every week. Between 400 and 500 people obtain refreshment every day from the American bar, and quite half of these are American "temperance" drinks. In the German restaurant there are sold in a year 80,000 special German dishes and 500,000 portions of German lager beer. The Turkish bath is visited by 180 people every week, and the hairdresser's shop by 500 customers. Our own bakers make for the hotel 3,000 separate portions of bread every day; and in one year our own laundry-lists numbered 1,500,000 articles. Ours, I think, is the only complete sub-post-office in a hotel in this country. We despatch and receive in one year 50,000 telegrams and a million telephone messages. There are 500 telephone instruments in the hotel. In twelve months we issued postal orders and money orders to the value of £5,000, we sold £2,500 worth of postage-stamps, and we issued nearly one hundred Savings' Bank-books. There are 7,200 electric lights in the building. Electricity costs £6,500 a year, and gas £100 a month. These are a few miscellaneous figures taken at random from our first year's return. I could quote many more, but perhaps these will suffice to show that the business of the Midland Hotel is of a very exceptional character, and its future welfare a matter in which the general public of Manchester, as well as the shareholders of the Midland Railway, have at any rate a parallel interest.

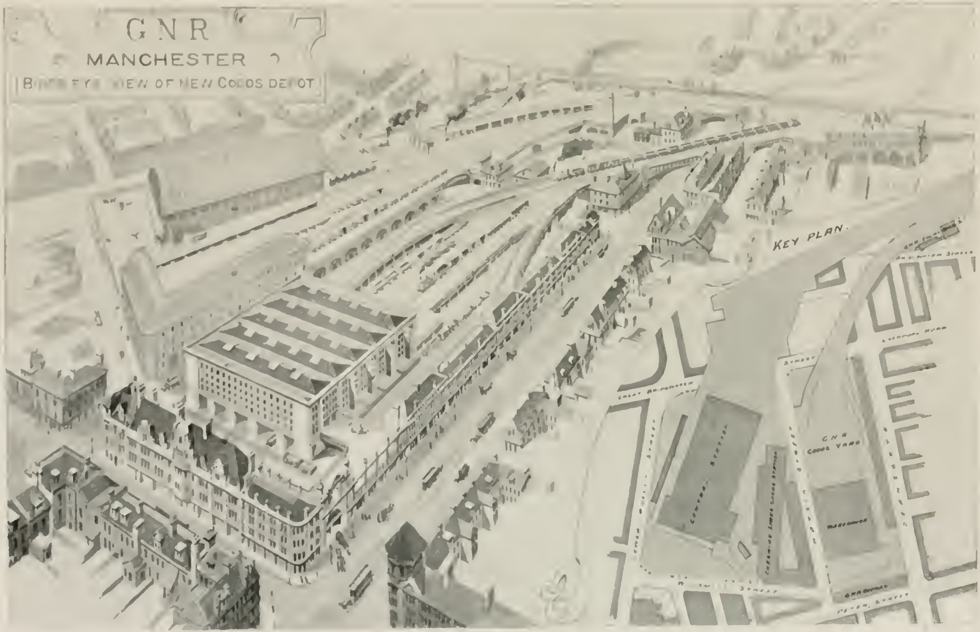
Outside the great cities, our railway companies have a large number of hotels erected or acquired for various purposes. Those which may be classified as "junction hotels" date from the time when railway travelling was less expeditious than it is at present, and when it was more often necessary to "break the journey" for the night. Thus the picturesque Park Hotel, Preston, which belongs jointly to the London and North-Western and Lancashire and Yorkshire Railway Companies, was intended to serve as a stopping-place for the night for passengers passing between London and Scotland by the West Coast route, and also for Anglo-Irish passengers travelling *viâ* Fleetwood. But the running of sleeping-cars on the trains, and the great improvements made in the Irish cross-Channel boats, have resulted in the large proportion of the travellers by both these routes travelling through by night instead of breaking the journey, and thus, in this case, as in that of the platform dining-rooms already mentioned,

DRYING-ROOM, WILLESDEN LAUNDRY, L. AND N. W. R.
Photo by the Commercial Photographic Co.]

IRONING-ROOM, WILLESDEN LAUNDRY, L. AND N. W. R.
Photo by the Commercial Photographic Co.]

the railway companies have been penalised by their own progress. On the other hand, the great ease of travelling at the present day has made it possible for railway companies to invest money profitably in another class of hotel—*viz.*, those which have been erected so plentifully in recent years at seaside and other pleasure resorts for the accommodation of tourists and holiday-makers. In connection with the growth of the popularity of golf, an opportunity has arisen for the encouragement of railway travelling amongst the well-to-do classes of the community by the development of new golfing resorts, and in such cases the railway companies have thought it a good investment not only to provide hotels, but also to lay out links in connection therewith, and to organise tournaments and championship matches by way of advertising their enterprises. The Great North of Scotland Railway Company at Cruden Bay, the Glasgow and South-Western at Turnberry, the Belfast and County Down at Newcastle (co. Down), and the London and North-Western at Greenore, are instances which occur to me of combined hotel-and-golf-course enterprises on the part of railway companies, and probably half-a-dozen others, at least, could be mentioned.

A few words should be said as to the organisation of the commissariat department of a great railway. Generally the whole business—hotels, restaurant-cars, and refreshment-rooms—is placed under the charge of a head-manager, with offices at head-quarters, and a number of assistants located at the principal centres. The appointment obviously requires very great talent for organisation, and special knowledge as to all matters appertaining to food and drink and the comfort of guests, as well as a strong physique to stand the wear and tear of the constant travelling necessary to keep in touch with all the ramifications of the department. In addition to all the things already mentioned, the commissariat manager of a large railway generally has several laundries under his charge, for the washing of the linen of the company and its guests. The London and North-Western has no less than five laundries at various centres; and in connection with the one at Willesden, where the London washing (amounting to about 75,000 articles per week) is done, the North-Western keeps about 250 chickens and 100 pigs—the former to supply eggs for the Euston Hotel, and the latter to convert the waste food of the hotel and restaurant-cars into pork. In a few cases the buying of the wines—a work requiring special skill and judgment—is not done by the commissariat manager, but by an outside expert. But as a general rule the manager supervises the buying as well as the selling of everything. Skilful buying is, in short, the basis of success in the caterers' business.



GOODS STATION, MANCHESTER, AND ADJACENT PREMISES, G. N. R.

CHAPTER IX.

The Work of the Wagons.

THE work of the goods departments of our railways does not bulk so largely in the public eye as that of the passenger branch of the organisation. Everybody is interested more or less in the running of the "crack" expresses, and everybody has a grievance, more or less acute, anent the unpunctuality, slowness, or inconvenient timing of some passenger train by which he or she is wont to travel; whilst the arrangements of stations, the intricacies of time-tables, and the behaviour of guards, porters, and ticket-collectors vie with the weather as subjects of conversation when casual acquaintances meet. The doings of the "luggage-trains," on the other hand, do not interest the general public, except so far as they interfere with the passenger working, when their presence on the lines is sometimes regarded as a highly censurable lapse on the part of the management. To the attention of people who look at railways from this point of view, I must again commend the fact—that the goods traffic of our railways brings in more revenue to the companies than the passenger business. Of the total of over 111 million pounds which formed the gross receipts of the railway companies in the United Kingdom in 1904, 55 millions came from the carriage of goods (including minerals, general merchandise, and live-stock), 48 millions was from passengers (including parcels and mails), and the remaining eight millions was revenue from steamboats, canals, harbours, docks, hotels, and other miscellaneous sources. From the carriage of minerals alone the receipts for the year amounted to £25,672,000.

It was, indeed, for the carriage of coal that railways were first promoted in this country. The promoters of the first public line—the Stockton and Darlington—did not in their original estimates calculate upon any revenue worth speaking of from passenger traffic, and it was not until several weeks after the railway was opened that they took the trouble to run a single passenger-coach. Later on, however, when the possibilities of developing highly remunerative long-distance passenger and general goods traffic began to be realised, the owners of the pioneer trunk lines, such as the London and Birmingham, looked upon minerals with something like disdain. It is on record that when coal-trucks first passed over this line, they were sheeted down, that their contents might not be recognised, and that at Weedon, where coal was transferred to the railway from the barges of the Grand Junction Canal, there stood for many years a high screen, erected to conceal the nature of the business carried on.

The directors of the Stockton and Darlington line, when seeking Parliamentary powers for the construction of that railway, fixed the rate for the conveyance of coal at 4*d*. per ton per mile. The coal-owners of the district, whilst acquiescing in this proposal so far as "land-sale"—*i.e.*, locally consumed—coal was concerned, asked for a much lower rate—*viz.*, 1½*d*. per ton per mile—"for all coal shipped in the river Tees for exportation." Parliament granted this request, much to the annoyance and discouragement of the promoters of the railway, who thought that such a charge could not possibly be remunerative. Experience soon proved that the directors were wrong; indeed, the success of the Stockton and Darlington Railway Company was largely due to the immense volume of mineral traffic for export which was developed under the stimulus of the low rates charged. At that time practically the whole of the coal supply of London was drawn from the Durham and Northumberland fields *viâ* the ports of the North-East coast, the Midland and Yorkshire collieries being too far from the sea to compete successfully. When, a few years later, the Leicestershire and Derbyshire coal-owners got railways constructed to their pits, they endeavoured to make a bid for the London trade; but, as already stated, the directors of the London and Birmingham line—then the only railway running into London from the North—were not disposed to fill their rails with coal-trucks to the detriment of better-paying passenger and merchandise traffic. They therefore refused to haul the Midland coal at the low rate of $\frac{3}{4}d.$ per ton per mile, which was all it could pay if it were to compete successfully with the sea-borne coal from the Tyne, the Tees, and the Wear. It was not until the Great Northern Railway was opened to London in 1850 that the metropolitan consumer began to receive a regular rail-borne supply. The Great Northern from that date not only hauled coal from the South Yorkshire pits to London at the then unprecedentedly low rate of $\frac{1}{2}d.$ per ton per mile, but undertook the duties and responsibilities of coal merchants at King's Cross.

Mr. Herbert Clarke, a name destined to be widely known in the London coal trade (whose brother, Mr. Seymour Clarke, was then general manager of the Great Northern), was appointed about that time "sole agent for the sale of the coals carried by the company," and it was not until about eight years later that the system of the railway company acting as coal merchant through his agency was abolished—the other northern lines having in the meantime developed a similar business—and the present method brought into vogue, whereby a number of firms rent depôts on the companies' premises and act as middlemen between the public and the collieries, the railway authorities restricting themselves to their proper business as carriers.

The mineral traffic of the railways of the United Kingdom in 1903 reached the huge weight of 342,563,000 tons out of a total of 443,830,000 tons of goods of all kinds carried. The Midland Railway

BRICK-TRAIN, G. N. R.

Photo by Locomotive Publishing Company.]

15-TON COVERED GOODS VAN, L. AND N. W. R

15-TON COAL-WAGON, L. AND N. W. R.

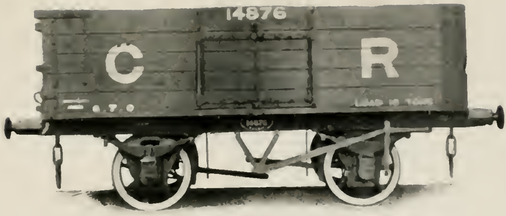
is the largest individual coal-carrier amongst the companies, its main line to London having been primarily constructed, as previously stated, for the development of coal traffic to the Metropolis from the Derbyshire and Nottinghamshire fields. In 1871, soon after the opening of the Midland line, a great war in coal rates raged between that company and the Great Northern, in the course of which the charge for bringing coal from the South Yorkshire and Midland pits to the Metropolis was brought down to below a farthing per ton per mile. It now averages about a halfpenny. In fixing the rates to be charged on coal traffic, it is necessary for the railway companies to depart to a large extent from the mileage principle, so as to equalise the charge from the various producing fields to a common centre; otherwise, the collieries nearest the market would have a monopoly of the trade. For the same reason it is necessary to fix what are known as "group" rates between all the collieries in a field and the adjacent ports or markets. Otherwise, it would not be profitable to work pits which happened to be a few miles further than their competitors from the place of export or "land sale."

Coal traffic, in short, affords an excellent example of the basis upon which all charges made by railway companies have to be regulated, and which is expressed in the phrase "charging what the traffic will bear." Coal is the life-blood of modern industry, and by facilitating its carriage the railway performs one of the greatest of its public services. But were the rates to be charged on the hard-and-fast principles advocated by some theorists, many collieries now worked at a profit would be inexorably shut out from the markets, to the advantage of those producers possessing the best geographical situations, but to the serious detriment, not only of the other would-be producers, but also of the whole body of consumers, to whom the price would be raised in proportion as the supply was restricted. By adjusting their rates on a free commercial basis, without rigid subservience either to the distance covered or to the cost of the individual service rendered, the railway companies are in a position to keep open all available sources of supply. One thing, however, they are bound by law not to do, and that is to give an "undue preference" to one customer over another by charging him a lower rate "for the same or similar services." But, paradoxical as it may appear, this does not prevent a company from charging different rates on coal, or other merchandise, carried from the same collieries or place of production to a common destination, supposing the one consignment be for export and the other for home consumption. In a recent case heard before the Railway Commissioners it was proved that a higher rate was charged on coal destined to be made up into briquettes for export than on coal carried the same distance over the same line for shipment in its raw form. Yet the Commissioners held that the difference between the rates did not amount to an "undue preference." In short, the Legislature has given the railway companies of the United Kingdom a fairly free hand in carrying out the principle of "charging what the traffic will bear"; and such is the competition between the companies, and such their keenness to increase their revenues, that every effort is made to "tap new strata" by quoting special rates below their maximum charging powers.

Everyone at the present day is acquainted with the fact that the population of the United Kingdom is very largely dependent upon producers abroad for its supply of foodstuffs and other commodities. It follows from this that there is a very large import traffic flowing from the ports to the great centres of population, and it is, of course, the aim of every railway company to attract as much of this traffic as possible on to its lines. This business is all the more desirable from the railway companies' point of view because it arrives in large consignments, and strongly and handily packed, having already performed a journey by sea, and probably also over some foreign railway. Many of the large centres of population in this country are themselves ports—London, Glasgow, and Liverpool, for example—and are therefore in a position to obtain their foreign supplies by an all-sea route. But the railway companies owning lines from other ports to these centres—especially if they are also owners of the docks—naturally make special efforts to compete with the all-sea carriage, and this they can only do by quoting rates which, when combined with the shorter sea-freight, shall not be higher than the freight by the all-sea route. These special import rates are in some cases less than half those charged to the home producer for the carriage of the same description of goods over the same or a shorter section of the line.

For example, it was recently proved in the Railway Commissioners' Court that whereas a charge of 6*s*. a ton only was made for the conveyance of foreign produce from Southampton Docks to London, a distance of seventy-six miles, a charge ranging from 13*s*. 11*d*. per ton from Southampton Town, to 8*s*. 4*d*. per ton from Woking, twenty-three miles, was charged for the conveyance of home merchandise of the same description. This, on the face of it, looks like a gross injustice to the English agriculturalist. Nevertheless, the Commissioners held that the difference in charge did not amount to an "undue preference," for two reasons—first, because the foreign produce reached the railway in so much larger consignments and so much more handily packed; and, secondly, because the special import rates were necessary in the interests of the public to keep open a convenient alternative route for the conveyance of foodstuffs to the Metropolis. Special import rates, in short—obnoxious though they must be to the home producer—stand on the same footing as special export rates—which the home producer, of course, applauds. They are necessary to keep open distant markets.

It is, as I have already pointed out, practically impossible for the most expert general manager to be sure whether any one branch of the business of his line is "paying" or not. But the object of his labours



16-TON COAL-WAGON, CALEDONIAN RAILWAY.

20-TON COAL-WAGON, G. N. R

30-TON COAL-WAGON, G. N. R.

is to earn a fair dividend on the whole, and with this view he naturally seeks to secure the highest attainable of proportion of those classes of freight which he thinks the most remunerative. One class of traffic may seem desirable because of the high charges it can bear, and another because, though low rated, it can be carried in full loads, conveniently packed. Neither of these attractive features are, unfortunately, at the present time possessed by most of the agricultural produce sent by rail by the home producer. But wherever our farmers have taken any pains to study the conditions of economical railway transport and to consign their products in large loads, suitably packed—which can usually be done only by combination amongst themselves—the railway companies have shown themselves ready to grant specially low rates for the sake of opening up new markets. Not that traffic in small consignments is despised. The Great Eastern Company, for example, has made special arrangements to carry by passenger train from ninety-eight different stations on its line to London, farm produce, packed in boxes supplied by the railway company, at the extremely low rate of 4*d*. for any weight up to 20 lb., including free delivery within the ordinary limits —another 1*d*. being charged for every additional 5 lb. up to a maximum of 60 lb. It is difficult to see how such an arrangement can be remunerative to the railway company, except indirectly by increasing the prosperity of the agricultural districts which it serves; and there are critics who allege that the system favours agriculturists at the expense of other customers of the line.

For the purpose of fixing charges for railway conveyance, Parliament has classified the goods liable to be so conveyed into eight divisions, the classification being based partly upon the character and partly on the value of the commodities. Three of the classes are distinguished by letters, A, B, and C, and the others by numbers, 1 to 5. "Class A" traffic, which includes coal and other minerals in their raw state, is carried at the lowest rates, whilst the highest scale of charges is made for the goods belonging to "Class 5," which includes the most expensive, fragile, and least easily transportable of manufactured articles. Most of the goods in the lettered classes do not require to be carted by the railway companies, and are accordingly carried at what are known as "S. to S."—*i.e.*, station to station—rates. The numbered classes, on the other hand, have, as a rule, to be collected and delivered by cart at either end of their railway journey, and their normal rates are known as "C and D" rates.

The Parliamentary classification of goods carried by rail contains approximately 2,300 entries, which might be thought comprehensive enough to embrace all conceivable articles of traffic. The railway companies themselves, however, have found it necessary to draw up, by the agency of their Clearing House, a much more detailed catalogue, known as the General (or Working) Railway Classification, which at the present time embraces nearly 5,000 items, and is growing at the rate of about 100 new entries yearly. The edition dated 1st January, 1904, contains 123 pages in double columns, similar to the one reproduced below. Even the most

GENERAL RAILWAY CLASSIFICATION OF GOODS, 1904. 75

	Class.
Meat Pies	4
†Meat Safes	4
Medals, *metal, not gold, silver, or plated*	3¶
Megass—	
Hydraulic or steam press-packed	C
Machine-pressed	1
Not hydraulic or steam press-packed, or machine-pressed, in full truck loads, or in consignments of 20 *cwts.*	3
E.o.h.p.	4
Melons (*not hothouse*), *packed*	2
Menhadden Oil—	
In casks or iron drums, round or tapered at one end	1‡
E.o.h.p.	3
Mercury, *Bichloride or Perchloride of* (Corrosive Sublimate)—(*see* Special Classification, p. 215).	
Mercury, *Fulminate of*—(*see* Special Classification, p. 191).	
Merinos, *in bales, packs, or trusses*	3
Merinos, *e.o.h.p.*	4
Metabisulphite of Potassium	2
Metal Cement, *in slabs, packed*	1
Metal Dross	C
Metal Polish (Liquid)—(*see* Special Classification, p. 199).	
Metals, *Anti-Friction*	2
†Meters, *Electric*	3
†Meters, *Gas*	3
Meters, *Water*	3y
Methylated Spirit—(*see* Special Classification, p. 203).	
Mexican Fibre—	
Hydraulic or steam press-packed	C
Machine-pressed	1
In hand-pressed bales	2
Not hydraulic or steam press-packed, or machine-pressed, in full truck loads, or in consignments of 20 *cwts.*	3
E.o.h.p.	4
Mica	3
Middles, *Wood Pulp*	1

	Class.
Middlings	Cg
Mile Posts, *cast iron*	C
In less lots than 2 *tons*	1
Military Ornaments, *except gold, silver, or plated*	3¶
Military Ornaments, *e.o.h.p.*	5
Milk, *e.o.h.p.*	3
Milk, *in bottles packed in straw, in cases*—(as Preserves).	
Milk, *condensed*—(*see* Preserves).	
Milk Cans and Pans, *tinned iron*	2
Milk Cans and Pans, *e.o.h.p.*	3
Milk, *dried, in casks*	2
Milk Food, *dried, in tins, packed*—(as Preserves).	
Milk Substitute, *for feeding Cattle*	1
Millboard	1
(*Exceptional rates for Paper apply.*)	
Millboard Rollers or Tubes (*for winding Paper*), *in cases*	3
Mill Cinder or Tap	A
Mill Scale or Smudge	B
Mill Sweepings, *Oily*—(*see* Special Classification, p. 227).	
Millet	Cg
Millinery	5
Mills, *Bone Crushing*	2
Mills, *Coffee, small Hand*	3¶
Mills, *Corn, (Portable)*—(*see* Agricultural Engines, &c., p. 131).	
Mills, *Hand, e.o.h.p.*	4
Mills, *Mortar*	1
Mills, *Oil Cake*—(*see* Agricultural Engines, &c., p. 131).	
Mills, *Sugar*	2
Millstones, *in the rough*	C
„ *finished*	2
Mincing Machines	3¶
Mineral Black (Hydrated Oxides of Manganese)	1
Mineral Black (Ground Coke), *in casks or bags*	C
Mineral Oils, including Paraffin and Petroleum—(*see* Special Classification, p. 204).	
Mineral White	C

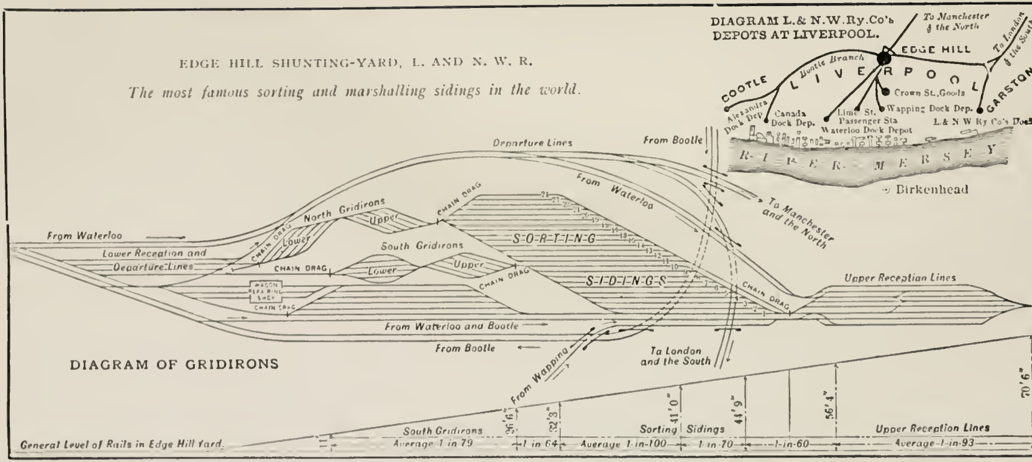
† If not properly protected by packing to be only accepted at Owner's risk.
‡ Grocery List No. 1. ¶ Hardware List.
g. Grain List. y. Reduced rate at Owner's risk.

encyclopædic knowledge must discover its limitations when glancing through this stupendous list of marketable commodities, which begins with "Acacia" and ends with "Zoedone." In addition to the ordinary classification, there is a special classification of explosives and other dangerous goods carried by merchandise trains, comprising upwards of 100 pages of matter, and showing the charges and conditions under which they are carried. The practice of the railway companies, before deciding the classification of such commodities as these (or, indeed, of any article where there is a doubt as to its composition), is to consult their official chemists, the usual arrangement being for these officers to meet periodically at the Railway Clearing House, where they draw up a report for the Goods Managers' Conference, giving the result of their investigations and making their recommendation as to the class to which the new commodity belongs.

The law provides that all articles not specified in the Parliamentary classification may be charged "Class 3" rates; but sometimes the Goods Managers decide that new articles of an easily transportable character are entitled to be put into a lower class. On the other hand, it is occasionally necessary for the companies to apply to the Board of Trade for permission to charge a higher scale on articles of a fragile or combustible character. Recently this had to be done in the case of gramaphone records—to give one example of the newly invented commodities which constantly come up for classification.

EDGE HILL SHUNTING-YARD, L. AND N. W. R.

The most famous sorting and marshalling sidings in the world.



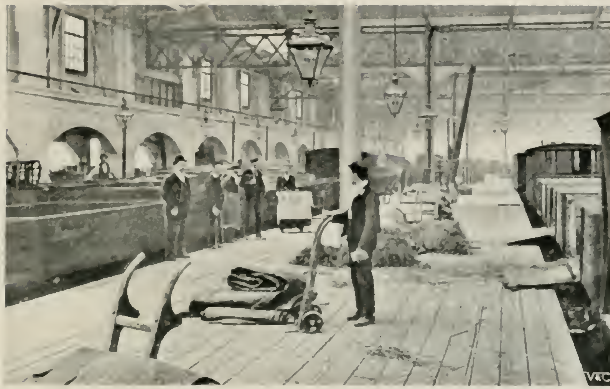
The complications connected with the charging of freight give opportunities to unscrupulous traders to defraud the companies by consigning their goods under false and misleading descriptions. To prevent this, the railway companies now employ a staff of special inspectors, whose duty it is to open packages and compare their contents with the description entered by the consignor on the consignment note. Numerous instances of attempted fraud have in this way been discovered, and the parties having been prosecuted, heavy fines have been imposed.

For the information of the customers of the railways, a rate-book is kept at every station, in which all rates in force from that place are entered. This book is open to every trader who wishes to inspect it, and with the guidance of the classification book he is able to ascertain from it exactly what he will have to pay for any consignment he desires to send. The London and North-Western Company, for example, has about 1,500 of these rate-books distributed throughout its system, containing nearly thirty million different rates; and, of course, every other company has millions of local rates of its own, in addition to the through and competitive rates which are common to several companies. It will be readily understood from these figures that the work of the "rates office" (which is a branch of the goods manager's department) is no sinecure. The number of new cases which arise each day in most of the principal railway companies' rates-offices amount to upwards of 500, to say nothing of another two or three thousand letters to be attended to about matters already in hand. Necessarily this work requires a very large staff of experienced clerks.

In our chapter on "The Control of the Trains," we saw that it was the aim of every railway traffic manager to haul the goods in as long trains as possible, in order to economise locomotive power and occupation of the running lines. To this end it is the duty of the officers in charge of the goods stations to see to it that not only each engine has its full load to draw, but also that each wagon is filled with the best load attainable. This would at first sight appear to be an object not very difficult of attainment—at least, as between the more important centres; but on looking into the matter a little more deeply, we come upon one of the great drawbacks, from an economical point of view, of a highly competitive railway system such as that of the United Kingdom. Were all the traffic between London and Manchester, for example, to be carried by the company possessing the shortest route—to wit, the London and North-Western—it would be comparatively easy for it to be dealt with in full train and wagon loads. But as a matter of fact, no less than five other companies actively compete for this one branch of business—the Great Eastern, the Great Northern, the Midland, the Great Central, and the Great Western. The best attainable loads are thus divided by six, whilst in the keenness of competition a standard of celerity is set up which makes it impossible for any one of the companies to delay consignments for the purpose of avoiding sending away a train light or a wagon three-parts empty. Mainly from this fact it has come about that the average loading of the goods wagons even on the best-managed lines does not exceed three tons, which figure is in itself a marked improvement upon what was done ten years ago, before the question of wagon and train-loading received special attention. As, generally speaking, the wagons used on our lines for general merchandise have a tare of six tons (with a capacity of eight tons), this means that the average "live" load hauled per wagon is only about one-half the dead weight. The waste of locomotive power which results therefrom, and which is incurred also in hauling goods over circuitous competitive routes—such as the Great Western's or Great Eastern's to Lancashire, for example—is a very serious set-off against the advantages which accrue to the trading community from railway competition in respect to speed and "facilities" generally.

The despatch with which goods traffic is conducted on our railways, though wasteful in respect to the haulage of dead weight, is in some other respects not uneconomical. The great expense of providing terminal accommodation for goods traffic in large towns is a big item in the railway companies' capital accounts. The large goods station recently constructed by the Great Northern Railway Company at Manchester, for example, cost no less than a million sterling. To provide the site, which cost about two-thirds of the whole expense, about nine acres of streets and houses, including a brass-foundry, a chapel, a burial-ground, a school, and quite a number of public-houses, had to be either swept away or bridged over. For the foundations about 100,000 tons of soil had to be excavated, and for the erection of the building 25,000,000 bricks, 50,000 tons of concrete, 12,000 tons of mild steel, and about a million and a half granite setts and hard-wood blocks were required. The rivets used, if laid end to end, would reach a distance of sixty-five miles.

In London, each of the great companies has several goods stations of about the size of the one just described. Spacious as these depôts usually are, however, there is a constant tendency for the business to outgrow the accommodation. If, in addition to serving the purposes to which they are already put, these goods stations had to be used as sorting-centres for the accumulation of freight sufficient to make up full wagon-loads to every town on the line, their area would have to be very greatly enlarged. As things are, the motto is: "Keep everything moving." Practically every package received during the night from the "inwards" trains is cleared away by the company's vans by noon the next day, and the "banks" are then free for the accommodation of the outward-bound freight, the first trains conveying which are due to depart about three or four o'clock. The "outwards" departures continue until about midnight, soon after which hour the first "inwards" train is due again, and so the work goes round. Walking about the Camden



A "BANK" AT KING'S CROSS GOODS STATION, LONDON, G. N. R.

INTERIOR OF GOODS TRANSHIP SHED, CREWE, L. AND N. W. R.

(London) goods station of the London and North-Western Company one morning, I was shown a very small pile of goods in one corner of the huge shed. "That is all we have left undelivered of last night's consignments," said the foreman. His remark did not, of course, embrace the "warehoused" goods, which I subsequently saw in a spacious building of wide floors and many storeys adjoining the shed. These goods are specially consigned to wait the orders of the traders, an extra charge being made by the railway company for their storage.

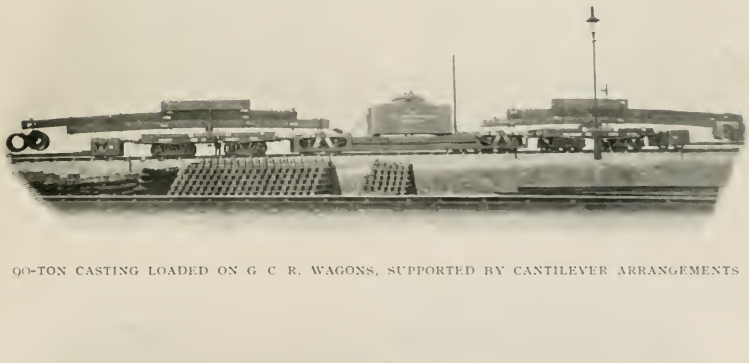
Not very long ago, one of our railway managers had a careful observation made of the work done at one of the largest town goods stations on his line. He found that on the day selected, the total number of consignments was 985, consisting of 4,427 packages, weighing 123 tons, to be despatched to fifty-three different destinations. The average weight per consignment was thus only 2½ cwt., and the average weight per package 62 lb. These statistics illustrate the very retail character of the general goods traffic on British railways, and the extreme difficulty of making economical use of wagons of large capacity in the conveyance of that traffic under a system which requires that every consignment should be dealt with immediately it is received. In the instance under notice, in order to get the 123 tons to the fifty-three different destinations, seventy-two separate trucks had to be used, the average load per truck being only 34 cwt. To carry 34 cwt. in a truck having a tare of 6 tons is wasteful enough; but to use trucks of the American type, with 40 or 50 tons capacity, and 15 to 20 tons tare, for the conveyance of consignments of 34 cwt., would be too ridiculous for words.

In order to facilitate the carriage of general merchandise in fuller wagon-loads, a system was introduced on the London and North-Western a few years ago which is likely to be generally adopted on our railways. It consists of having what is called a "tranship shed" at some central point of the system —not a large town—to which place all consignments, not in themselves sufficient to make a good wagon-load to their ultimate destination, are in the first instance despatched. Here all goods are "transhipped," and the accumulation thus gathered from the different parts of the system enables good wagon-loading to be made to all important places, whilst for the minor stations "road-vans" are made up to travel at the tail of the goods trains and be dropped at a succession of small places not sufficiently important to each receive a separate wagon. As stated in a previous chapter, the London and North-Western Company's chief tranship station is at Crewe, where a large shed, thoroughly equipped with all necessary appliances, has been erected near the junctions of the various lines converging upon that centre. The system has been most successful in improving the loading of wagons and reducing the number of vehicles required to be hauled; and as everything is cleared up daily, the same as at the ordinary goods stations, no delays of any consequence are entailed. As this system is developed, the average loading of general merchandise in railway wagons will, no doubt, be still further improved, and trucks of larger size than those at present in general use may ultimately become economical. Probably the ideal to be aimed at for this class of traffic is the general employment of covered vans having a cubic capacity of about 1,500 feet each, and equipped with continuous brakes. These vans could be loaded up at the principal goods stations and conveyed at high speed to the transhipping points, and thence, with sorted loads, to the ultimate destinations of the consignments.

As regards that part of their traffic which is of a wholesale character, every effort is being made by our railway companies to reduce the cost of conveyance by dealing with it in large train and wagon-loads. The beginning has been made in most cases with the company's own coal conveyed from the collieries to the engine-depôts for use as locomotive fuel. This traffic is now usually conveyed in trucks of twenty or thirty tons capacity, and so, too, are bricks, sand, iron ore, etc. It might be thought an easy matter to arrange for the whole of the coal which is brought to London and other large towns to be conveyed in similarly large vehicles; but this is not the case. Although very large in total weight, the house-coal trade of the country is dealt with in surprisingly small consignments, on account of the very large number of depôts distributed throughout London and other towns, and the necessity for keeping at each depôt a supply of, perhaps, a dozen different sorts of coal to suit the varying requirements of the customers. Observations made recently showed that on an ordinary day at one of the London coal-depôts, eighty-three small wagons of coal were received, of which thirty-two were single consignments of one truck apiece from different collieries, whilst there were eleven consignments of two trucks, four of three trucks, three of four trucks, and only one of five trucks. For only eight, therefore, out of a total of fifty-one consignments would it have been possible to use thirty-ton wagons; and the London and North-Western authorities estimate that eighty per cent. of the house-coal carried on their line is consigned in loads of less than twenty tons. Moreover, when the Great Northern authorities attempted to introduce twenty-ton wagons for this class of traffic, they found that at only twenty collieries out of 140 served by their system would wagons pass under the screens, on account of their greater height as compared with the stock hitherto employed.

The bulk of the coal conveyed by our railways is carried in trucks belonging not to the companies, but to their customers, the colliery owners and coal merchants. The ordinary rates charged for the conveyance of minerals are merely for haulage and terminal accommodation, an extra payment being exacted for wagon-hire if the truck be provided by the railway company. The North-Eastern is, indeed, the only railway company in the United Kingdom which is bound by statute to provide wagons for

GOODS SORTING-SIDINGS, CREWE, L. AND N. W. R.



90-TON CASTING LOADED ON G. C. R. WAGONS, SUPPORTED BY CANTILEVER ARRANGEMENTS

TWO LARGE GIRDERS LOADED ON G. W. R. TROLLEY-WAGONS.

mineral traffic. This system undoubtedly restricts the possibilities of economy in conveyance, and in 1881 the Midland Railway authorities decided to become the owners, as far as possible, of the whole of the wagon-stock running over their system. They accordingly spent a large sum in buying up the traders' stock. Having done this, however, the company, unfortunately, did not make its charge for wagon-hire sufficiently low to induce the traders to use the railway wagons, and there are now almost as many private owners' vehicles running over the Midland as on any other line. Traders' wagons have to be built to specifications drawn up at the Railway Clearing House, and they must each bear a registration-plate testifying that all the requirements of the companies have been duly complied with. But although they guard themselves in this way from having to haul improperly constructed vehicles, the companies have to depend upon the traders for selecting the most economical types, and they also have to perform a large amount of shunting and empty haulage arising out of the private ownership of the wagons. From the point of view of economy in working, it would undoubtedly be a great gain if the use of traders' wagons could be abolished. It is really a relic of a past age, when a different notion of the functions of a railway company prevailed. There is also room for improvement in the arrangements made between the companies for use of each other's wagons, the present system being responsible for a great deal of empty haulage to avoid the "mileage" and "demurrage" charges which are incurred on "foreign" wagons not returned to their owners within a very limited time.

Until a few years ago the ten-ton wagon was the largest size used for mineral traffic on our railways. Efforts are now being made by the leading companies to introduce, and to induce the traders to adopt, fifteen-ton wagons, which can be built with a tare of about seven tons, thus more than equalising the live and dead weight hauled, even when allowance is made for the empty return journey. A further advantage of this type of truck is that it can be built with the same wheel-base as the old-fashioned vehicle, thus getting rid of the difficulty as to turntables and tips at docks, most of which would have to be altered if the American type of eight-wheeled "bogie" vehicles were adopted in this country. A great deal of the coal traffic on our railways goes to the ports for shipment, and the arrangements of the tips, staithes, etc., govern the size of the vehicles used for this class of work. At some of the ports on the North-East coast it has been found possible to utilise eight-wheeled wagons for the conveyance of export coal; but generally speaking, the four-wheeled vehicle is a necessity of the situation. In the past, undoubtedly, too little attention has been paid to the relation of tare to carrying capacity in the design of British railway wagons, and as improved types are gradually introduced, very considerable economies are certain to result. It is very desirable also that more width should be allowed for wagons in yards, sheds, and depôts generally. Owing to the narrowness of the loading-gauge in these places, it is impossible, in the ordinary way, to use wagons more than 8 ft. 1 in. wide, although vehicles nine feet wide can pass over most of the running lines.

Another matter intimately related to the question of the size of railway wagons is the problem of siding accommodation. Railway companies are constantly obliged to extend their siding accommodation in and around London and other large towns, where land is very dear. The use of larger types of wagons would greatly relieve this difficulty by reducing the length of train required to accommodate a given load. A train of fifty-two ordinary four-wheeled coal-wagons, carrying eight tons of coal each, occupies 936 feet of siding. The same load of 420 tons could be put in a train 614 feet long if fifteen-ton wagons were used, thus saving one-third of the siding accommodation. We have seen that it is the practice on our railways to haul mineral traffic in as heavy train-loads as possible, and, therefore, the necessity is the greater to reduce as much as possible the length of the train by employing fewer vehicles to carry the loads required. A great saving would also be effected in capital cost and repairs by utilising a larger class of vehicle than the eight-ton or ten-ton trucks now generally employed.

Sidings have to be provided by the railway companies, not only for the accommodation of waiting trains and for terminal purposes, but also for the sorting of wagons and their marshalling into proper train order, according to the various destinations to which they are consigned. The most famous sorting and marshalling sidings in the United Kingdom—and, indeed, in the world—are the great "gravitation" yard laid out by the London and North-Western Company at Edgehill, near Liverpool. Every afternoon and evening from 2,000 to 2,500 wagons are brought to Edgehill from the various docks, quays, and depôts in and near Liverpool. They are brought there as soon as they are loaded, and without reference to the trains which they will ultimately form, and in which they will run to all parts of the United Kingdom. They are first placed on the reception-lines at the summit of the series of sidings, where the engines leave them. They are then sorted by gravity into the upper group of storage sidings, consisting of twenty-four parallel lines, each of which receives the wagons destined for a particular train. Shortly before the time a train is required to commence its journey, the vehicles forming it are passed into one of the departure lines through two groups of short lines expressively termed "grid-irons." The use of the gridirons is to enable any change to be made in the relative positions of the trucks which may be necessary to allow every train to leave on its journey with the wagons so placed that each one can be detached at the station for which it is intended, with the least possible amount of shunting. The whole work is done by gravity, without the use of any method of haulage, the sidings

60 WAGON-TRAIN OF "EMPTIES" RETURNING TO THE COLLIERIES, L. AND N. W. R.

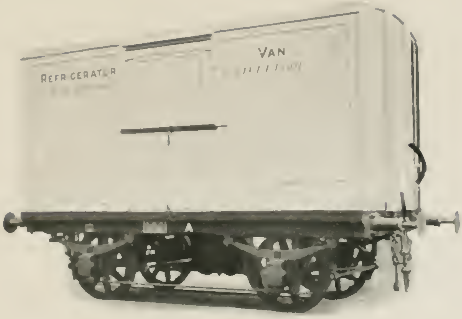
SHUNTER, COUPLING UP WITH COUPLING-STICK.

SHUNTER, UNCOUPLING WITH COUPLING-STICK.

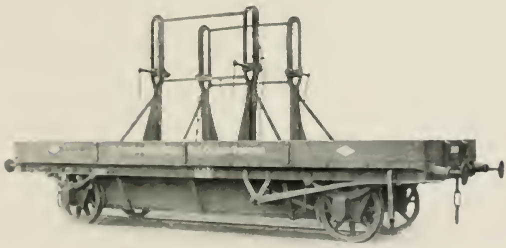
being so arranged that the release of the hand-brake is sufficient to start each wagon on the course it is desired to follow. Should any truck run away too fast, it is stopped by a sand drag situate at the neck of each group of lines. The sending of wagon after wagon through a neck into a series of parallel sidings is known as "fly" shunting, and demands considerable dexterity in the manipulation of the points so as to ensure the truck going on to the right line. Where a suitable incline is not available, a shunting-engine or a horse is employed in marshalling wagons into trains. In the goods stations themselves the work of moving the wagons in and out is done by ropes operated by hydraulic or electric capstans, or by horses, whilst turntables are employed to get them from one line to another, and hoists for conveyance between the two storeys of which many modern stations consist. Both goods stations and marshalling sidings are, as we have already noted, brilliantly illuminated by electric light, as a great deal of the work has to be done at night.

It is a matter for deep regret that, whilst so high a degree of safety has been attained in the conveyance of passengers on railways, the goods traffic still exacts a mournful toll of fatalities and accidents from amongst the *employés* of the companies. Every effort is made by the authorities and by the Board of Trade inspectors to diminish the dangers of work in the shunting-yards, but in too many cases "familiarity breeds contempt" of the regulations laid down, while a certain number of the accidents belong to the class which seem unavoidable even with the exercise of the utmost care. In former days a great many casualties resulted from the shunters having to go in between the buffers to couple and uncouple the wagons ; but by the use of the coupling-stick with which every shunter is now supplied, the necessity of going between is avoided, except in the case of tight-coupled passenger stock. The ingenuity of inventors has long been directed to the evolution of a type of automatic coupler which shall be suitable for the four-wheeled side-buffered wagons employed on British railways, the American coupler being only practicable with " bogie " stock, which allows free play in going round curves. It is by no means certain, however, that automatic coupling is really safer than the use of the coupling-stick with the present loose-link arrangement. The provision of hand-brakes capable of being applied and released from either side of the wagon is another improvement which has been strongly agitated for in the interests of the safety of the men, as many accidents are said to arise from the necessity of shunters running round wagons in order to apply or release the brakes. This problem is at the present moment engaging the attention of the companies and the Board of Trade, and it is hoped that a satisfactory type of either-side brake will be evolved.

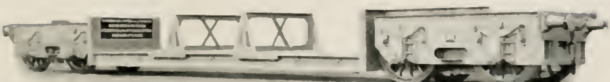
For a reason already explained, the Midland has the largest wagon stock of all our railway companies, the number of vehicles provided by that company for the conveyance of minerals, general merchandise,



REFRIGERATOR-VAN, L. AND N. W. R.



GLASS-WAGON, L. AND N. W. R.



PLATFORM-WAGON, G. E. R.

Photo by Locomotive Publishing Company.]

RAIL-WAGON, L. AND S. W. R.

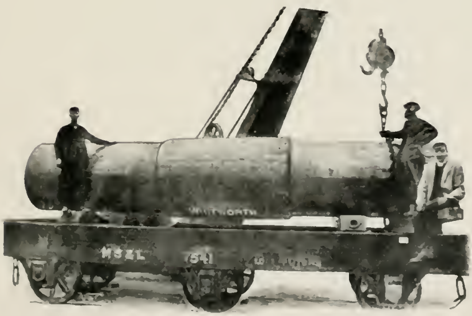
Photo by Locomotive Publishing Company.]

and live-stock being not far short of 120,000. The North-Eastern comes next with nearly 100,000, whilst the London and North-Western has over 76,000. In addition to open wagons and covered vans, many special types of vehicles are kept on every large railway. There are beer-vans, butter-vans, cattle-wagons of various sizes, furniture-wagons, glass-wagons, gunpowder-vans, meat-vans (including a number specially fitted with refrigerating appliances), rail-wagons, timber-wagons, tool-vans, and trolleys of various kinds.

For the conveyance of very heavy articles, special types of vehicles are employed, one of which is known as a platform-wagon, the platform being suspended between two four-wheeled "bogie" trucks, as shown in the illustration facing page 236. When the Glasgow District Cable Subway was constructed, some years ago, it was necessary that a rope, seven miles long, made in one unjointed and unspliced length, should be conveyed by rail from Warrington, where it was made, to Glasgow. It was originally coiled over one immense reel, 12 ft. 6 in. long by 8 ft. 6 in. diameter, the total weight being sixty-eight tons; but it being considered unsafe to convey so great a concentrated weight over the railway bridges, the rope was re-coiled on to two reels for conveyance by the London and North-Western Railway Company, as shown in the illustration facing page 238. The Great Central Railway authorities have on several occasions succeeded in arranging for the conveyance over their line of castings weighing as much as ninety tons, of one of which feats we also give a picture facing page 230. This casting was loaded on a fifty-ton trolley and supported by cantilever arrangements over two forty-ton "bogie" wagons, with a small well-trolley at each end to guard the balance weights. It was worked through specially on a Sunday at a speed limited to fifteen miles an hour. An illustration facing page 230 shows two girders weighing twenty-one tons each, $66\frac{1}{2}$ ft. long and 9 ft. 8 in. high, loaded on Great Western trolley-wagons; whilst yet another picture facing page 238 shows a gun-coil, or hoop, brought up from Manchester to King's Cross by rail, for the Royal Naval Exhibition of 1891. It was carted to the Exhibition by a team of twenty-five horses.

Difficulties of a different kind present themselves when articles of exceptional width are offered to railway companies for conveyance. No railway company likes to refuse traffic; yet when the width of the commodity concerned is greater than that of the loading-gauge of the line, it would seem, at first sight, to be an impossibility to meet the wishes of the would-be customer. Quite recently it was desired to send from London to Liverpool, to catch a departing "liner," a gunboat 75 ft. 3 in. long, 6 ft. 3 in. deep, and 9 ft. 8 in. wide. As already stated, nine feet is the extreme width permissible to vehicles passing over the main lines of our railways, whilst in many of the sidings and depôts the loading-gauge is only 8 ft. 1 in. Nevertheless, the London and North-Western Railway authorities succeeded

CONVEYANCE OF GLASGOW DISTRICT SUBWAY CABLE,
7 MILES LONG, BY L. AND N. W. R.



GUN-COIL LOADED ON M. S. AND L. R. WAGON.

BOAT LOADED ON L. AND N. W. R. WAGONS.

in getting the gunboat safely to Liverpool, albeit they had only a day or two in which to make the necessary arrangements. The work was carried out on Sunday, 31st July, 1904—which, being the Sunday before August Bank Holiday, was not a very convenient day. The gunboat was mounted on a trolley 3 ft. 8 in. above rail level, so as to clear the sides of the station platforms. During the whole of its transit over the 194 miles between London and Liverpool the section of line adjoining the track on which it was running was kept closed, so as to prevent collision with any passing train. In short, single-line working was put into force, section by section, over the whole of the company's main line to Liverpool, so that this very bulky consignment might be got through safely without any risk of damage to itself or danger to the other traffic of the railway. Such exceptional work as this entails a large amount of extra labour and anxiety upon the officials concerned, and while willing to oblige their customers in every possible way, the railway companies are not in the least anxious to increase the traffic in very bulky or heavy articles such as those above referred to. They would distinctly prefer them to be sent by other routes.

Very curious are some of the consignments which railway companies have to carry at times. Forty tons of silkworms' eggs were once sent by the London and North-Western for shipment to Japan, and great care had to be taken to keep them cool, lest they should hatch on the journey. At one of its London warehouses, the same railway company holds at this day an undelivered consignment, consisting of a stone figure in human form, about twelve feet high, which is believed to be the fossilised remains of an Irish giant, excavated near the Giants' Causeway. The figure has been in the possession of the railway authorities for no less than twenty-eight years, and they are unable to sell it—as is usually done with unclaimed goods—because the original consignee is dead, and his effects have been put into Chancery. The question to whom the supposed fossilised giant really belongs has never been settled, and the railway company has the figure still on its hand, with a claim for warehouse rent which now amounts to over £175. Prior to being consigned by rail from Manchester to London on the 28th of August, 1876, the giant was exhibited in America and in Ireland. Should the Court of Chancery eventually allow it to be put up for sale at the annual salvage auction held by the railway company, it will be probably the most unique article ever offered even at these sales, where the most heterogeneous collection of lost property is disposed of year by year. Quite lately the North-Western had a baby-incubator left on its hands, which, when sold, realised a very small sum.

A corpse is a very expensive consignment to send by rail, the uniform charge made by our railway companies for the conveyance of dead bodies being one shilling per mile. Several cases have occurred in which the attempt has been made to evade this heavy expense by a concealment of the nature of the consignment. In one case the body of an actor who died on tour was consigned to his home by the surviving members of the company as "theatrical effects," and the fraud being detected, legal proceedings were taken against the responsible parties for the recovery of the balance of the railway charges. In another instance, a bereaved but thrifty husband, having the misfortune to lose his wife when they were taking a holiday away from home, consigned the body by goods train under a false description, whilst he himself returned home in the usual way. On arriving at his destination, great was his concern to find that the remains of his lamented spouse did not come to hand. Inquiry of the railway officials was rendered difficult by his reluctance to furnish a description of the missing consignment, but eventually anxiety got the better of meanness, and he made a clean breast of his misdemeanour. The telegraph-wires were soon set to work, and the errant corpse was found in a siding near a neighbouring town.

When goods are received at their journey's end without an invoice giving particulars of their destination, it is customary to open the package with a view to tracing the missing information. A large box thus opened at a London goods station revealed what appeared to be a dead body, and this being reported to the official in charge of the station, he thought it wise to communicate with the police. The officers of the law decided that it must be conveyed to the nearest mortuary, where in due course it was "sat upon" by a coroner, assisted by twelve "good men and true." They decided that the contents of the box were undoubtedly a corpse, but that it had been dead some years, and that its discovery did not point to any recent crime. The body was then buried, but subsequently the invoice turned up, and it was found that the box had contained a mummy, and that its destination was a museum in Belgium. The remains eventually reached the museum, but in a rather damaged condition. Some time afterwards the railway company received a very indignant letter from a lady in Peru, who stated that she had been to very considerable trouble and expense in obtaining the mummified remains of a Peruvian Inca for the Belgium museum, but that, owing to the negligence of the railway authorities, the mummy had reached its destination in a condition not fit for exhibition. The railway company denied liability on the ground that if the box had been properly addressed and its contents indicated upon it, the mistake could not have occurred. The Courts decided against the railway company, who had to pay heavy damages to the aggrieved consignor of the mummy, and the official whose action led to the inquest being held on a body which had been dead thousands of years has now no further ambition to walk in the footsteps of Sherlock Holmes.

TEAMS LOADING UP AT A SMALL GOODS STATION, G. N. R.

HORSES BATHING AT G. N. R. HOSPITAL, NEAR KING'S CROSS, LONDON.

Photo by C. Pilkington.]

CHAPTER X.

Collection and Delivery.

THE first railway companies in the United Kingdom were formed with the intention simply of providing tracks, over which coach proprietors, carriers, and traders and travellers generally would conduct the business of transport in much the same way as over a highway, a navigable river, or a canal. Almost before the lines were opened, it became evident that, in the interests both of safety and efficiency, the railway company must supply the motive-power as well as the permanent way; and the exclusion of passenger carriages, other than those owned or hired by the companies, soon followed. But to this day, as noted in the preceding chapter, a large proportion of the mineral and goods traffic carried over our railways is conveyed in what are known as "private owners' wagons"; and yet, on the other hand, the companies have gradually, step by step, become the owners of a most extensive and varied equipment for carrying on work as carriers and caterers for travel and traffic, off the rails, both on land and by sea. If the London and North-Western, for example, were not world-famous as a railway company, we might think of it more often than we do, as the owner of a fleet of Channel steamers second to none for the kind of work they do. The North-Eastern Railway Company are amongst the largest dock-owners in the United Kingdom. The Midland, as a hotel company, takes rank with the "Gordon" or the "Frederick"; the North Staffordshire is an important canal company, and the Great Western has done more within the last year or two to develop the use of motor vehicles as public conveyances than any other corporation, company, or individual.

The collection and delivery of goods at the stations is absolutely a voluntary service, undertaken by our railway companies from purely commercial considerations. It is a service, moreover, which is not performed to the same extent by the Continental railways, and not at all by the railways of America. The class of traffic which our railway companies collect and deliver, as well as carry by rail, is in America handled almost entirely by the express companies, who in many cases not only perform the street cartage at either end of the railway journey, but furnish their own trucks, send their own servants over the lines in charge of the freight, do the loading and unloading, and in some places provide their own station accommodation. In a word, their relation to the railway companies of America is analogous to that existing between the Post Office and our railway companies in respect to the Parcel Post traffic; except that the express companies there do a good deal more than the postal authorities do here.

With such exceptions as the Parcel Post, and the business done by private firms of "packed parcels" agents, or by forwarding agents who deal with oversea traffic, the "express" system does not exist in England. Even firms like Messrs. Pickford, and Messrs. Chaplin and Horne, who were in business as carriers in England long before the advent of railways, have become content to act merely as cartage agents to the railway companies. These old firms, however, did not give up their former priority without a struggle. For some years after the introduction of the railway system, they tried to keep the railway companies in a secondary position as sub-carriers, responsible only to them, and having directly no contact with the customers; and the control they had obtained over the business in the days of the canal-barge and pack-horse made it dangerous for the railway authorities too hastily to supersede the old firms. By way of compromise, a sort of partnership was in many cases formed between the railway company and the carrier, the most prominent instance of which was the arrangement which existed until a few years ago between the London and North-Western and Messrs. Pickford. Similar alliances were made in every town where influential firms of road carriers existed; and some of the leading railway companies—the Great Western, for example—did not find it necessary for many years after their incorporation to provide a single horse and cart of their own. But as the railways pushed their way into new districts over which no other carrier had obtained an ascendancy, or where a competitive line, on entering a town, found the existing cartage connections already appropriated by its rival or rivals, it became necessary for the companies to organise their own equipment for collection and delivery. Having once established a horse-and-cartage department, the railway authorities naturally began to ask themselves whether it would not be more economical to supersede some of their cartage agents by employing their own teams elsewhere.

The agency system is by no means dead yet, but in process of time it seems doomed to extinction—so far, at least, as the more prosperous railway companies are concerned. Some of the poorer ones are glad to keep it on, and even to extend it, because it saves them from the necessity of large capital expenditure on horses, carts, stables, receiving-offices, etc. Broadly speaking, it is no doubt better in the interests both of customers and shareholders that the railway company should undertake the whole responsibility and do the whole work of conveyance between sender and consignee. The intervention of a middleman means that the charges must cover a second profit, with no off-setting economy except in the few cases where larger loads can be made up. Were the railway companies of the United Kingdom to combine to hand over the whole of their general goods and parcels traffic to a single firm or corporation of carrying agents, undoubtedly immense economies

A LOAD OF HOPS, L. AND N. W. R.

A LOAD OF FISH EMPTIES, L. AND N. W. R.

might be effected ; but such a monopoly would not be tolerated by public opinion, unless it were under the strictest Government supervision or in the hands of a State department like the Post Office. As an alternative to the complete nationalisation of our railways, there is, I think, a good deal to be said in favour of an arrangement whereby a national organisation analogous to the Post Office should take charge of the class of traffic which is handled by the express companies in America ; but the financial details of the change would be enormously difficult to work out.

Sir George Findlay once said in a lecture that the staff of men and horses which the London and North-Western Railway Company employed in the collection and delivery of goods in London exceeded, he believed, the number required to work all the coaches and vans that ran in former days to and from the North. If this was true in the days of his general managership, when at least a third of the North-Western's cartage in London was done by Pickford, it must fall far short of the truth of to-day, when a very largely increased business is carried almost exclusively by the company's own teams. Certain it is that, including not only the railway companies' own studs, but the auxiliary teams employed by the cartage agents, the number of horses employed in the transport of goods throughout the United Kingdom at the present day is far in excess of the total at work before railways came in " to ruin the English breed of horses "—as croakers averred—

and "reduce the equine *genus* to the level of a museum exhibit." The London and North-Western and the Midland each own over 5,000 horses—the North-Western nearly 6,000—exclusive of the number they employ through agents in various towns; the Great Northern has 2,782; the Great Western, 2,668; the Lancashire and Yorkshire, 1,867; and the Great Eastern, 1,745. If we compare these figures with the locomotive returns of the same companies, we find that in every case the number of horses owned is considerably in excess of the total of the iron steeds. In the cases of the Midland and the Great Northern, the horses outnumber the locomotives in no less a proportion than two to one. The fears of some of the old-fashioned opponents of the railway would surely have been allayed could they have foreseen that after seventy years of steam locomotion, two horses would be employed for each engine in the conveyance of the traffic of some of the leading lines. And now that the iron horse itself is threatened with extinction by the progress of electricity, the devotees of the steam locomotive may find comfort in the oft-proved experience that a new invention frequently supplements rather than supersedes an old one.

There is, however, one sphere of railway work from which horses are very properly being withdrawn, as fast as science and capital can supply a mechanical substitute. I allude to the work of the shunting-yards. There are still a great many shunting-horses employed on our railways—the Great Eastern, for example, has 275 of them—and their life, particularly at the small country stations which abound on such a line as the Great Eastern, is easy and agreeable enough on the whole. But no one can ignore the risks to which horses engaged in shunting are exposed when their work has to be done in close proximity to lines of fast and frequent traffic. Intelligent though they are, and wonderfully wary as with experience they become, casualties amongst their number, as in the case of the shunters themselves, unhappily occur, not only by getting run over—which is a comparatively rare thing—but from their liability to catch their feet on or between the rails, or to trip over the numerous bars and wires which abound at busy junctions. Many a broken leg and sprained foot result from these causes, despite the care which is now taken by the engineers' departments to cover up obstructions and fill in holes at all places where shunting work has to be done. In all goods yards of modern design the shunting-horse is superseded by hydraulic or electric capstans, which do the work with greater efficiency and less cost ; and at the present rate of progress in mechanical invention, it may be confidently predicted that the shunting-horse, like Othello, will soon find " his occupation gone " at all but the quietest of country depôts and stations.

Most railway companies pay a good price for their horses, buying them young and in the best of condition after they have been well broken in to work by a spell on a farm. The average working life of a railway horse is between five and six years, at the expiration of which time the animals still have sufficient work left in them to command a fair price for farm duty again. It is considered good policy for a railway company to have all its horses, as far as possible, in the pink of condition, and this can be achieved only by generous buying, good feeding, careful working, and constant attention to the health of the stud. Then when the time comes to sell, the horse superintendent is rewarded by getting back nearly a third of the money he originally paid for each horse. About £60 is considered a fair price to pay for recruits for a railway stud, and one of the companies gets on the average as much as £23 for each horse sold after nearly six years of regular service. This last figure is, however, rather above the average price realised on horses sold by the companies generally. Usually out of a large railway stud three or four at least are killed by accident during a year, whilst the number that die, or have to be destroyed, is about two per cent. of the total kept. Even these, however, are not a total loss to the department, as the carcasses sell for about thirty shillings each. As to the uses to which the various parts of a dead horse are put, it will probably be well for our comfort not to inquire too closely; but it is interesting to know that the animal oil extracted from the carcase is re-sold to the horse-owner for use in the harness-room.

To stable hundreds of horses in great cities like London, Glasgow, Liverpool, Birmingham, or Leeds is a difficult thing for a railway company to do with-

SHUNTING-HORSES AT WORK, G. N. R.

Photo by C. Pilkington.

CARTING A BIG BOILER, L. AND N. W. R.

STEAM MOTOR WAGON, N. E. R.

out incurring prohibitive expenditure for land; for the majority of the animals must be housed within a short distance of the central goods depôts. Companies whose lines run into great cities on viaducts find it economical to convert the arches into stables, whilst in other cases accommodation for the horses has been provided underground beneath buildings erected by the companies for other purposes. Most of the modern stables, however, are constructed on the upper floors of premises devoted to other uses, or in buildings of several storeys specially constructed so as to give the maximum accommodation with the minimum occupation of land. At the Great Western stables near Paddington 626 of the 1,500 horses kept by that company in London are housed in a building having four floors of stables, whilst the Great Northern at Clerkenwell has three storeys of stables accommodating 189 horses in a building the ground floor of which is devoted to a goods warehouse. The animals make no difficulty of ascending and descending the inclined ways which lead from one floor to another, the fodder and bedding being taken up by mechanical hoists. For the erection of its newest stables the Great Northern has utilised a piece of waste land situated over the entrance to one of its London tunnels, and here nearly 200 horses are accommodated in a handsome triangular range of one-storey buildings. This company has stables in London underground, on the level, and with several floors, and its horses thrive equally well in each of these types of home. The great thing is to give plenty of space and air to each animal; of exercise they get enough in their daily work.

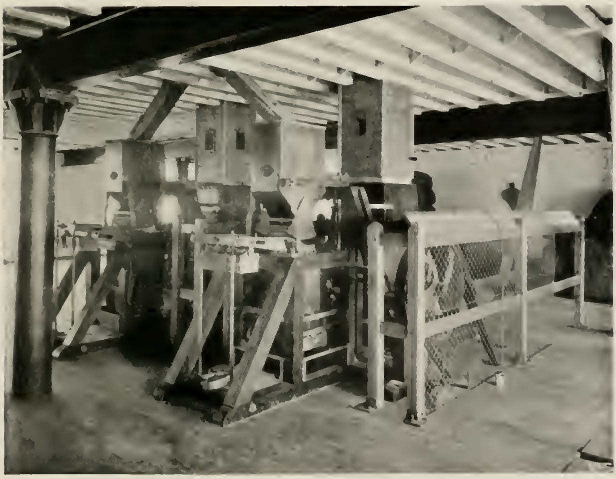
A succession of visits to railway companies' stables has convinced me that in the treatment of horses expert opinions differ as widely as on most other subjects. Some stables, for instance, are fitted with hanging bales between the stalls, others with fixed partitions; and the exponents of each system are equally convinced that theirs is better than the other. As regards bedding, the diversity of opinion amongst railway horse superintendents is still greater, some using straw, others sawdust, others chips and shavings, and others moss-litter—a compressed form of peat, which used to be almost exclusively imported from Denmark, but is now dug largely out of the Yorkshire moors in the neighbourhood of Goole, where, I am informed, a "Danish village" has recently sprung up, the workers in the local moss-litter industry having been imported from that country. A great consideration is the selling price obtainable for the manure, and this no doubt influences some companies to employ straw, though the prejudice formerly existing against moss-litter manure amongst farmers has nearly died out—indeed, some now think it has special qualities as a soil-dressing. Where a railway horse superintendent can obtain a large supply of sawdust or chips from his own company's carriage works at the bare cost of conveyance, there is, of course, an advantage in employing that form of bedding. The permanent-way department also sometimes makes its contribution to the stables by supplying old rails, which are used in various ways, especially for the construction of drains in the stalls. The stables themselves, too, are as a rule designed by the company's chief engineer and erected under his supervision.

Nor are stables by any means the only buildings which railway companies have found it necessary to erect for the purposes of their horse departments. Provender stores, shoeing forges, harness factories, and horse hospitals are all items of the extensive and varied plant required by our railways in their capacity as road carriers; and some of the best equipped buildings of these various kinds in the Kingdom are to be found amongst the heterogeneous property of railway shareholders. If the reader wishes to visit a place where the preparation of food for horses has been brought to the highest pitch of perfection, he cannot do better than ask permission from the Great Eastern Railway Company to visit their Provender Stores near Romford—an establishment which to the uninitiated in such matters is a revelation both of engineering skill and of the care which is bestowed upon the nourishment of that humble member of the brute creation—the carrier's horse.

When the visitor alights from the train at the siding adjacent to these Stores, it is difficult for him to believe that the major part of the huge building confronting him is devoted to the purposes of a horses' kitchen, where the raw material of provender—hay, clover, sainfoin, oats, and beans—is cut or crushed, cleaned, sifted, and measured, so as to form the chopped mixture upon which the 1,745 horses belonging to the Great Eastern Company are fed. It is like one of the celebrated pork factories of Chicago, where the pig goes in at one end and the sausages come out at the other. On one side the trusses of hay and the sacks of oats and beans are taken in, at the other side come out the bags of mixed provender; and with the exception of the men who unload and load up the trucks at the sidings—pulling the raw material out of one set of wagons and piling the sacks of provender into another set—no human hand touches the corn or chaff during its passage through the store. There are four floors to the big building, and each floor is occupied by a different set of machines—cutters, crushers, sifters, cleaners, weighers, and measurers. Here and there we find a man in attendance, but practically the whole thing is automatic. Conveyors of various types carry the stuff upwards from floor to floor—endless bands, worms and scoops, all driven by electric power—and by its own gravity it descends again through shoots of diverse shapes. Into each machine, as it continuously works, falls its due allowance of hay or corn or mixture, until the chaff, oats, and beans have been reduced to that combination and form of provender which experience has proved to be most acceptable to the palate and digestion of the hungry cart-horse. During the process rather more than one per cent. of the raw material is extracted in the form of dust, whilst every few minutes any nails, screws, pins, etc., which may have found their way into the ingredients, are sifted out by the magnet

PROVENDER STORES AT ROMFORD, G. E. R.

Photo by Fred Spalding, Chelmsford.]



VIEW INSIDE PROVENDER STORES, ROMFORD, G. E. R.

Photo by Fred Spalding, Chelmsford.]

which unceasingly passes over the stream of provender at one point in its progress through this astonishing mechanical kitchen. Every week about 175 tons of provender are sent out from this Store, and the horse superintendent knows that every ounce of it is good, clean, nourishing food, freed from those gritty and metallic impurities which impair the digestions of the animals as surely as chalk or salt in water corrode the boiler of a steam engine. To Messrs. E. R. and F. Turner, Ltd., Engineers, of Ipswich, belongs the credit of having designed and supplied most of the machinery for the Great Eastern Company's Provender Stores. The Great Northern has a similar institution at Holloway, and the Great Western at Didcot ; indeed, every one of our large railway companies has found it necessary to provide an establishment of the kind, and the Great Eastern's is specially mentioned here simply because it is the newest and therefore the most up-to-date in its mechanical appliances.

Notwithstanding the care taken in respect to food and stabling, and the fact that all the animals are in the prime of life, sickness amongst railway horses cannot be entirely prevented. The severity of their work, relieved though it be by frequent periods of rest, makes them specially liable to ailments of the feet and legs, whilst throat and lung troubles are also common, especially with those which work in towns. It is a noteworthy fact that almost all the young horses develop colds as soon as they arrive in town from the farms at which they have been bred. To provide accommodation for "seasoning" these recruits and for the treatment of the sick, every large railway company has its special range of hospital stables at its headquarters, and most of them also have a country convalescent home within easy distance of their principal horse depôt. The Great Northern's horse hospital—to again give one example typical of the rest—is situated within a mile of King's Cross, on an elevated, breezy site at the summit of that remarkable region north of the Euston Road, which is given up almost entirely to the occupation of the three great trunk lines running from London to the North. Miles and miles of sidings—of the existence of which passengers by these lines know next to nothing—testify to the immensity of the traffic in goods and coal which the needs of the Metropolis demand; and one can imagine that the young farm-horse, when he is discharged from the "box" in which he has performed his journey to town, feels as great a shock of surprise at the change in his surroundings as does the country bumpkin on emerging into the crowded streets from one or other of the great passenger termini near by. A few weeks' rest in one of the quiet, cosy stalls of the "reception stables" under the daily care of an experienced "vet." soon sets him on his "town legs"; indeed, this horse hospital in the heart of busy London is in some respects the counterpart of the farm from which he has come—so fragrant are the country smells, so homelike look its straw-yard and its ranges of well-filled stalls. Equally refreshing must this

HOSPITAL STABLES, NEAR KING'S CROSS, G. N. R.

Photo by C. Pilkington.]

A HORSE AMBULANCE, G. N. R.

Photo by C. Pilkington.]

rural atmosphere be to the invalids—gathered here from all parts of the Great Northern system—who occupy a homely looking, two-storeyed range of stables forming the other wing of the hospital. Here every resource of veterinary science is at the service of the sick animals; even oxygen and chloroform are not denied them; while the arrangements for hydropathic treatment, if not so elaborate as at Matlock or Ilkley, are an efficient aid in the treatment of foot troubles. Even the "Turkish bath" is sometimes called into requisition for sweating sick horses, and at Totteridge, where the Great Northern has its convalescent home for horses, this was, until recently, part of the regular treatment in certain cases. Modern veterinary opinion, however, favours hot baths of the "Russian" variety, it having been found that horses sweat more freely under the application of steam than they do in a hot-air chamber.

Shoeing-forges and harness-making-shops are interesting auxiliaries to the horse departments of our railways. At small stations the shoeing is let out on contract, but at most large depôts the railway companies find it more economical to have their own forges. As to harness, horse-collars, and nosebags, the practice varies; but some companies make all these articles in shops of their own, with the aid of the most approved types of labour-saving machinery. At King's Cross I saw a stitching-machine in the harness shop, driven by electric power supplied from the lighting works at Holloway, which did in twenty minutes an amount of work which it would have taken a man a day to do by hand, whilst near by was another machine, with the help of which eighty provender sacks were being turned out in a day, as compared with fourteen a day before its introduction. In another room a man was engaged in making horse-collars. This is a highly skilled form of work which requires a long apprenticeship, but a skilled operator can turn out seven a week. As showing the care exercised to prevent waste, it is interesting to know that those parts of the stuffing used for railway carriages which would otherwise be thrown away are sent on to the horse department for use in the making of these collars. To prevent the horses' necks becoming galled, the collars in use are dried after each day's work, and each horse has its own collar set apart for it, so as to ensure an easy fit. No detail, in short, is thought too trivial, if it conduces to the health of the animals or to economy in the work of the department.

Complaint is often made against railway carts that they block the streets in town by waiting about for long periods in front of offices and warehouses; and before the recent Royal Commission on London Traffic, several witnesses urged that railway companies ought to be prohibited from placing their receiving-offices in main thoroughfares, in consequence of the obstruction caused by the vans waiting outside these premises. It must not be forgotten, however, that a railway company is engaged in trade, and has an equal right with other traders to select the most suitable sites for carrying on its business. With equal force might it be contended that the existence of large and popular shops on important streets is an obstruction to traffic, as a great many vehicles stop outside these shops for long periods during business hours. In order to test this point, the authorities of the London and North-Western recently had statistics collected as to the number and duration of the stoppages of vehicles outside three of their London receiving-offices, as compared with those of the most frequented West End shops. It was found that not only did more vehicles stop at the shops than at the railway offices, but that they stopped considerably longer outside the former than the latter, the average duration being over ten minutes in the case of one of the shops, as compared with an average of from three to five minutes outside the receiving-offices. Yet no one thinks of suggesting that the big shops should be banished from the great thoroughfares in the interests of "rapid transit"!

No doubt the competition which exists between railway companies in this country is responsible for a great many more vans being on the streets of our great towns than would be the case if goods and railway parcels, like letters and post-parcels, were all dealt with by one national organisation. On the other hand, competition promotes celerity. Were railway carriage of goods a monopoly, it is more than probable that the bulk of the work of collection and delivery would be performed by heavy, lumbering vans, horsed by two or more crawling animals, which would cause far more obstruction, team for team, than do the light, one-horse vans—always on the "trot" when the road is open to them—in which the bulk of railway cartage is now done in large towns. Heavy vans are, of course, employed for special branches of the work—and even traction-engines have to be hired for exceptional loads—but the tendency is becoming stronger every year to lighten the loads and reduce the tare of the vehicles, so as to secure the quickest possible despatch. The modern type of railway van is designed to move quickly, and the "crawler" amongst this class of vehicle is becoming a thing of the past.

The speed with which the town cartage work of railway companies has to be done has, up to the present, proved an insurmountable obstacle to the employment of motor-vehicles in place of horses and carts. This may seem at first sight a paradox, but a short explanation will make my meaning clear. At a large city goods station the consignments for delivery begin to arrive soon after midnight, and by 7.30, when the horses are ready for work, the porters have loaded, perhaps, 200 vans, which by 8 a.m. are all despatched upon their rounds. There are (say) another 200 vans still available, and the loading of these is at once taken in hand and completed about 10.30. About this time the first set of vans are beginning to return empty, and all that has to be done is to transfer the returned teams to the newly loaded vehicles and send them out again. Thus the same teams provide the motive power for a double set of vans. Having delivered their second

MOTOR CHAR-A-BANC, G. W. R.

MOTOR-'BUS, G. W. R.

Photo by Gibson and Sons, Penzance

loads, they take on collecting orders, and return to the station a second time with their vans loaded with "outwards" goods. Then the horses are taken to the stables and fed and rubbed down by the stable hands, while the drivers have their dinners. While this is taking place, the vans are being unloaded, and after dinner they can at once be taken out again for the afternoon collections. It will be readily seen that these arrangements would have to be entirely altered if motor-vehicles were employed, as the motors could not be detached from the vans, like the horses, to serve a double set of vehicles, and it would not pay to keep the motive machinery idle for long periods while the vans were being loaded and unloaded at the stations. In crowded streets a motor-vehicle has little advantage over a horse in point of speed, whilst for backing up to warehouses and standing at the angles often desirable in busy thoroughfares, it is less suitable than the horse-van with its simple fore-carriage and possible sideways position of the horse. The stabling and cleaning of motor-vehicles, and the storage of the many gallons of petrol required, would also be "hard nuts to crack," if the railway companies were to decide to substitute mechanical power for horse-propulsion in London and other great cities.

In country districts, on the other hand, motor traction has already become a useful auxiliary of the railway; but even there its utility has proved very limited so far as the collection and delivery of goods are concerned. For comparatively heavy weights, conveyed between fixed points in regular loads, a motor-wagon with a "trailer" behind it is probably more economical than a pair-horse van or lorry, but such conditions only occur occasionally in railway work. The bulk of the business done, in country and in town, consists of the cartage of light loads, with a great deal of loading and unloading *en route*, and, consequently, much waiting about. Under these conditions the weight carried per day per vehicle is very light, and the tendency is more and more against the employment of heavy vehicles except for special work. The sphere awaiting the motor is not so much in substitution for the horses and carts already employed, but as an alternative to the construction of a branch line to reach some place or places, a number of miles away from the railway, which are not adequately served under the established conditions. There is probably a good opening for automobilism to establish regular connections between our railways and some of the large villages which hitherto have been left "high and dry" at a distance of ten or twelve miles from the nearest station. A regular service both of passenger and goods motor-cars, run by the railway company and connecting with its trains, is likely to prove the industrial salvation of places thus circumstanced, and already several of the companies—notably the Great Western and the North-Eastern—have instituted some very interesting and praiseworthy experiments in this direction, which are being closely watched by the authorities of other lines.

HOLYHEAD HARBOUR.
The Headquarters of the L. and N. W. Railway Company's Irish Channel Fleet.

TURBINE STEAMER "PRINCESS MAUD."
Stranraer and Larne Joint Railway Steamship Service.

TWIN-SCREW STEAMER "CAMBRIA."
Holyhead and Dublin Express Passenger Service, L. and N. W. R.

CHAPTER XI.

Docks and Steamships.

JUST as it could be said of old that "all roads lead to Rome," so can it be said to-day that "all railways lead to the sea." The ocean is the natural goal of the railway-builder, because there he can join his artfully laid track to that great natural highway upon which ride the argosies of the world. The insular position of the United Kingdom, and the absolute dependence of the masses of our population upon foreign trade for their means of subsistence, make the connection between our railways and shipping a particularly close one. The connection is fundamentally the same as that between railways and road cartage, referred to in the last chapter; but the alliance now under notice is a much more equal one than the other. No one would think of saying that the railway companies collected and delivered the traffic of our road carriers; one would always express the fact the other way round. But you can say the railways collect and deliver for the ships, or the ships collect and deliver for the railways without risk of libelling the dignity of either party.

Yet, whereas no shipping company owns a railway, a good many railway companies own ships, and a still larger number of railway companies own docks and harbours. Railway companies have, indeed, created ports at not a few places on our coasts, and so brought into existence ships which otherwise could not have been launched for lack of facilities for obtaining cargoes. In short, the power of the railway extends over the sea as well as over the land; nearly every large railway company in the United Kingdom has a docks, harbour, or marine department, and quite a number of them would take leading rank as shipping or docks companies, or as both, were not the importance of these auxiliary undertakings quite overshadowed in most cases by the importance of the railway. In the full titles of several of them, however, the word "Dock" is to be found—*e.g.*, the "Hull, Barnsley, and West Riding Railway and Dock Company,"* and the "Port Talbot Railway and Docks Company," etc.; and in one or two cases we find "Docks" coming in front of "Railway," as in "Alexandra (Newport and South Wales) Docks and Railway," "King's Lynn Docks and Railway," etc. In the case of the Furness Railway, it has been said that "the tail wags the dog," meaning by this that the company's excellent docks at Barrow are the most important part of its system, although they are not mentioned in its title. This remark would also apply to the Cardiff and to the Barry Railways.

* By an Act obtained in 1905, the title of this undertaking is now shortened to "Hull and Barnsley Railway Company."

To give an idea of the magnitude of the sea-power of our railways, let us briefly glance at the marine undertakings of the leading companies. The London and North-Western owns Holyhead Harbour, Greenore Harbour (Ireland), and Garston Docks (near Liverpool), and is joint owner with the Lancashire and Yorkshire of the docks at Fleetwood. Its Irish Channel fleet, plying between Holyhead and Dublin and Greenore, comprises sixteen steamships, and it has also a joint ownership in the five vessels plying between Fleetwood, Belfast, Londonderry, and in the three between Stranraer and Larne, and is part owner of Stranraer Harbour. It also owns a screw-dredger. The Great Western is owner of docks and harbours at Plymouth, Llanelly, Briton Ferry, Brentford, Bridgwater, Newquay, and New Milford, and, in conjunction with the Great Southern and Western Railway Company of Ireland, it is building new harbours at Fishguard (Pembrokeshire) and at Rosslare (co. Wexford) for the Irish cross-Channel traffic. An excellent fleet of steamers owned by this company plies between Weymouth and the Channel Islands and between New Milford and Waterford, whilst tenders are supplied by it for embarking and disembarking passengers in connection with the Ocean liners at Plymouth, and a ferry service is conducted between Kingswear and Dartmouth. Altogether the Great Western owns sixteen ships. The North-Eastern owns no steamships at present, though it contemplates doing so, and has an "interest" in the Hull and Netherlands Steamship Company. The

North-Eastern's dock property is very extensive, comprising a whole system at Hull, another at Hartlepool, Tyne Dock (from which seven million tons of coal are annually exported), Middlesborough Dock, the North Dock at Monkwearmouth, and extensive coal-shipping staiths at Blyth and at Dunston-on-the-Tyne. The Midland, although co-partner in the Stranraer and Larne fleet, and in some boats running from Barrow, had no marine department of its own until 1904, when it opened an extensive harbour at Heysham in Lancashire and commenced running its own steamships between that place and Belfast and the Isle of Man, a fleet of four first-class steamers being provided for that purpose, two of which are propelled by turbines. The Great Central is owner of the docks at Grimsby and has a fleet of thirteen powerful steamers trading between that port and Antwerp, Rotterdam, and Hamburg. The Lancashire and Yorkshire owns the docks at Fleetwood, and jointly with the North-Western runs a fleet of five steamers thence to Belfast and Londonderry. It also has its own fleet of five steamers between Liverpool (Collingwood Dock) and Drogheda. This company has recently purchased the fleet of the Goole Shipping Company, and has commenced to trade between Goole and Hull and a large number of Continental ports.

The Great Eastern has nine passenger steamers and three cargo boats trading between Continental ports and Harwich, where it has built the extensive Parkeston Quay and practically revolutionised the

THE EMPRESS DOCK, SOUTHAMPTON, L. AND S. W. R.

This photograph was taken at the time of the Joint Naval and Military Expedition, September, 1904, and shows some of the transports berthed.

THE NEW GRAVING-DOCK AT SOUTHAMPTON, L. AND S. W. R.

THE NEW COLD STORE AT SOUTHAMPTON DOCKS, L. AND S. W. R.

(Leased to the International Cold Storage and Lairage Co. Ltd.)

port. The Great Northern, alone amongst the northern lines of England, owns neither docks nor steamships. It made a contribution of £55,000 about twenty-five years ago towards the construction of a dock at Sutton Bridge, in Lincolnshire, but the site proved unsuitable. The dock refused to hold water, and has never been worked since the opening day—May 14th, 1881.

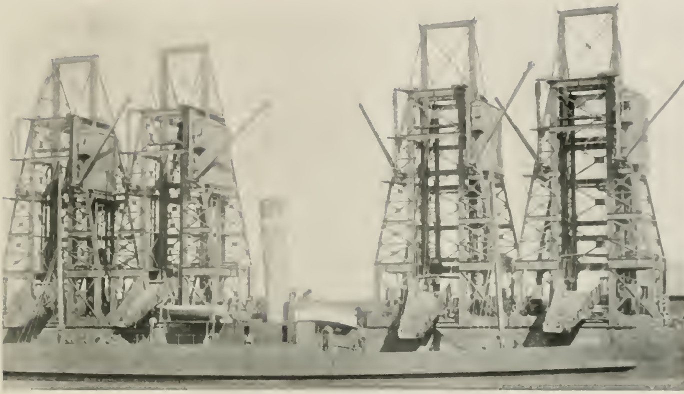
Turning to the railway companies owning lines south of the Thames, we find that one of their main objects is to carry traffic between the Metropolis and the sea. The London and South-Western owes much of its importance to its ownership of the Southampton Docks, and it has a fleet of fifteen steamships trading between that port and the Channel Islands and France, the South-Western route *viâ* Southampton and Havre being a favourite one with visitors to and from Paris. This company is also joint owner with the London, Brighton and South Coast of the excellent fleet which plies between Portsmouth and the Isle of Wight, whilst it runs two boats, all its own, between Lymington and Yarmouth (Isle of Wight), and has a tender at Plymouth. The Brighton, through the medium of a subsidiary undertaking, largely created Newhaven Harbour, which it works, besides owning the two boats which ply between that port and Caen. In partnership with the Western Railway of France, it also owns the fourteen vessels plying between Newhaven and Dieppe, to which the turbine-steamers *Brighton* and *Dieppe* are the latest additions. Its joint ownership of the Portsmouth and Isle of Wight boats has already been mentioned. The South-Eastern and Chatham are joint owners with the Northern Railway of France of the nineteen steamers which ply between Dover and Calais, and Folkestone and Boulogne, the newest of which, the *Queen*, *Onward* and *Invicta* are turbine-vessels. This company also owns the harbours at Folkestone and Whitstable, and has provided steamship facilities at Port Victoria, Queenborough, Strood, Gravesend, Rye, and on the Admiralty Pier at Dover.

Coming to the Thames itself, we find that the North London Railway Company owns the docks at Poplar and gives facilities there for the traffic of the North-Western, Great Western, and Great Northern companies. The Great Western and North-Western companies have a joint riverside station and dock at Chelsea, while the Brighton Railway Company has similar accommodation on the river. The South-Eastern and Chatham have Angerstein's Wharf between Greenwich and Woolwich, and another wharf at Blackfriars. The Great Western has a wharf at Brentford which has already been mentioned, and the London, Tilbury and Southend owns six steam ferry-boats plying between Tilbury and Gravesend, etc.

The group of prosperous railway companies in South Wales were laid down principally for the conveyance of coal for export. The Taff Vale Company owns Penarth Dock and Harbour near Cardiff, and provides accommodation of a more or less extensive character at and in connection with the other ports which it serves. The Barry created Barry Dock, and its railways are practically an appendage of that remarkable coal-shipping centre. The Cardiff was a dock company before it was a railway company, and is at the present time the owner of only three miles of railway in addition to the Bute Docks, Cardiff, and the extensive sidings connected therewith. The Alexandra (Newport and South Wales) Docks and Railway Company, and the Port Talbot Railway and Docks Company have already been mentioned. The Cambrian has Parliamentary powers to work steamships, but has not yet exercised them. The Barry obtained powers to run a service across the Bristol Channel in 1904.

Turning to Scotland, we find an equally close connection between railways and shipping. The North British owns docks or harbours, or both, at Methil, Burntisland, Bo'ness, Alloa, Charlestown, Kincardine, Tayport, Silloth, and Mallaig; the Caledonian at Grangemouth and Bowling, with the harbour of South Alloa and facilities at a number of other ports. The Glasgow and South-Western owns the harbours at Troon, Largs, and Fairlie, and holds a thirty years' lease of Ayr Harbour. All these three companies work excellent fleets of steamers on the Firth of Clyde, the North British and Glasgow and South-Western owning their boats outright, whilst the Caledonian does the business through the medium of a "controlled" Steam Packet Company which owns eleven vessels of 3,458 gross tonnage. The Glasgow and South-Western has a fleet of ten vessels of 4,847 tons gross, working in connection with its trains, and was the pioneer of the introduction of the turbine—in the *King Edward*. The North British fleet now consists of seven steamers, headed by the *Waverley*, which was the last paddle-steamer built in the nineteenth century.

In Ireland, the London and North-Western created and owns the harbour at Greenore, and runs a paddle-steamer on Carlingford Lough in connection with its daily services to and from Holyhead. The North-Western has also provided extensive accommodation both for passengers and cargo on the North Wall, Dublin—also in connection with its Holyhead service. Ireland is so well provided with natural harbours that expenditure by railway companies in this direction has not been so necessary as in Great Britain; but, as already stated, a new harbour is now being constructed at Rosslare—the work being carried out by the Fishguard and Rosslare Railway and Harbours Company, which is practically a joint committee of the Great Western of England and the Great Southern and Western of Ireland. The Lancashire and Yorkshire Company is about to expend a considerable sum upon the improvement of the Port of Drogheda, to which, as already stated, it runs its own steamers. The Belfast and County Down Railway Company runs a daily steamer during the summer months between Belfast and Bangor (co. Down), and this boat also makes Lough trips to Donaghadee, and a weekly journey to Larne Harbour. It should have been stated previously that the



THE FOUR MOVABLE HYDRAULIC COAL-TIPS AT PENARTH DOCK, TAFF VALE RAILWAY.

DISCHARGING WOOD-PULP AT PENARTH DOCK, TAFF VALE RAILWAY.

Caledonian and Glasgow and South-Western companies are co-partners with the North-Western and Midland in the Stranraer Harbour and in the Stranraer and Larne steamboat service, to which joint fleet there was added in 1904 a turbine vessel, *Princess Maud*. Allusion should also be made to the two steamers, the *Lady Margaret* and the *Lady Evelyn*, which the Furness Railway Company runs between Barrow, Fleetwood, and Heysham; and to the excellent Windermere fleet of the same company, consisting of five steam-yachts and a steam-barge, and the steam-gondola which it runs on Coniston Lake. The Furness and Midland companies were until recently joint owners of four steamers plying between Barrow and Belfast, and Barrow and the Isle of Man; but the Midland, since it opened the Heysham route, has bought out the Furness interest.

It is impossible to put into figures the value of the property constituting the sea-power of our railway companies, as the authorities generally do not make any separate returns of the capital they have invested in docks, harbours, steamboats, etc. A separate return is made to the Board of Trade of the revenue which the companies derive from this branch of their business; but the figures under this head include receipts from canals as well as from steamships, harbours, and docks. The total revenue of the railway companies from these four sources for the year 1903 was £4,005,923, which, if capitalised at 4 per cent., would represent an investment of about £100,000,000, or something like one-tenth of the paid-up "railway" capital of the United Kingdom. Probably the total sum sunk by the companies in provision for carrying traffic by water is considerably larger than £100,000,000, as it is not likely that these undertakings, on the average, earn as much as 4 per cent. Indeed, it is generally supposed that the dock, harbour, shipping, and canal properties of our railway companies are not, as a rule, directly remunerative properties, but are undertaken as "feeders" to the railway systems proper. Some of them probably pay very well, while others may be carried on at an actual loss, which is made up for by the receipts derived from the over-sea traffic carried on the railways.

A recent writer on "Ports and Docks," Mr. Douglas Owen, who has made a special study of his subject both in this country and abroad, has pointed out that the Continental system of State-assisted docks, and the British system of railway ownership, lead to very much the same results. The docks at Hamburg, Antwerp, and other great Continental ports —keen rivals with our own—are run by the State or municipalities, singly or jointly, and are very probably run at a loss. "But what does it matter," the citizens of these towns and States argue, "whether we make a profit on the docks or not? The object of docks is to bring trade to the country, and we make our profit on the trade." It would be exceedingly difficult for us in England to compete with ports designed and worked on a plan of such wise and magnificent liberality, were it not for our system of railway ownership. "For what does it matter," say the railway directors, "whether we make a profit on our docks or not? Their object is to feed our railway. They bring traffic to our metals, loads to our rolling-stock. We can afford not to make anything, or even to lose on our docks, because of what they bring to our railway system."

There are, of course, dock systems in this country which are both self-supporting and progressive. The great ports of Liverpool and Glasgow, for example, are each administered by a locally appointed trust on a perfectly independent and comfortable financial basis. But a port, to be successful "on its own," must have a very large population and a highly prosperous commercial community close at its back, as in the cases of the Mersey and the Clyde. When, as at Southampton, or Bristol, or Hull, the main part of the trade done is with comparatively distant markets, the locality itself is not strong enough to keep the facilities of the port abreast of the demands of the times and the competition of rivals. In the history of our ports, Bristol, with its Corporation ownership of the docks, affords an instance of neglected opportunities. Southampton and Hull, with railway ownership of the docks, afford equally striking object-lessons in progressive development. At Southampton the London and South-Western Railway Company, and at Hull the North-Eastern, came to the rescue of dock companies which were struggling in vain to keep their trade and had no power to develop it.

As regards extent, equipment, and capacity for business, the Southampton Docks of 1905 present a most impressive contrast to the same undertaking in 1892, on November 1st of which year they were taken over by the London and South-Western Railway Company. The dock company had no hydraulic cranes, no electric light for night working, a very inadequate system of quayside rails, insufficient shed accommodation, and only one dry-dock large enough to accommodate a modern liner. With the best available crane-power and lighting, twenty-five miles of dock railway and twelve locomotives, new warehouses for grain and wood, double-storey sheds on the quays, a new coal-barge dock, its own dredging-plant, two new graving-docks—amongst the largest in the world—several thousand feet of new deep-water quayage, the finest cold storage and lairage installation in Europe, and many minor improvements, the present Southampton Dock estate has little in common with the moribund and decrepit concern taken over by the London and South-Western Railway Company only twelve years ago. The traffic has increased to a corresponding degree—the goods traffic by about 90 per cent., the coal traffic by over 100 per cent., and the passenger traffic by 70 per cent. Unless the work had been done by the State, it is impossible to suggest how the money necessary to raise the port to its present excellence of equipment could have been found; and railway ownership has the inestimable advantage over State ownership that it carries with it commercial manage-

ANTI-BREAKAGE BOX USED IN SHIPPING COAL AT PENARTH DOCK, TAFF VALE RAILWAY.

FITTING A BOILER INTO A VESSEL AT SILLOTH DOCK, N.B.R.

ment. The South-Western Railway Company, whilst it can afford to be generous in its expenditure on the docks, has to earn a dividend on its undertaking as a whole, and this necessity is the best possible check upon extravagance or waste.

A factor which might not improbably have compelled the Government to lend a hand in the development of Southampton, had not the London and South-Western Railway Company been well able to do the work unaided, is the supreme importance of the port as a place for the embarkation and disembarkation of troops, owing to its proximity to the great military centres. This point was put in the forefront when the docks were originally constructed, but no one anticipated that either port or railway would be subjected to such a strain as in the early months of the South African war. The work then accomplished by the London and South-Western Company will not soon be forgotten, and it is no exaggeration to say that it materially helped to save the Empire from the terrible calamity of the overrunning of Natal by the Boers. It is not so generally known that during the joint naval and military manœuvres of 1904 arrangements were made between the Government and the railway company to test the capabilities of Southampton in an even more striking way. The great feature of the port as it now exists is that in addition to possessing one of the finest "open" deep-water docks in the world, it has an unusually large extent of ocean quayage, also accessible in perfect shelter at any state of the tide, to which additions are constantly being made by the reclamation of "the Mudlands." In connection with the joint military and naval expedition, no less than ten transports of 90,000 tons gross were simultaneously berthed in the Empress Dock and along the ocean quays on September 5th, 1904, and the test above referred to consisted in loading these in the shortest possible time with the men and *matériel* composing the expedition.

The force to be embarked consisted of 12,000 officers and men, 2,900 horses, 61 guns, 315 transport, engineer, and ambulance wagons, and 55 landing-boats, all of which had to be embarked over the quays except the boats, which were towed alongside and taken on board by the ships' gear. The work commenced at 7 a.m., and by 3 p.m. nine out of the ten transports had finished loading and got away, the other one being detained until 5 p.m. by a breakdown of its steering-gear. The disembarkation test, which took place on September 16th, was even more successful. All ten transports returned simultaneously, commencing at 9 a.m., and in an hour they had all been berthed, 9,000 of the troops were entrained at the docks immediately on disembarkation, together with a number of horses, and the remainder marched away with the cavalry, guns, wagons, etc. The whole expedition was clear of the docks by 3 p.m.—*i.e.*, six hours after the arrival of the first ship.

H.R.H. the Duke of Connaught, who was present with this expedition, personally expressed to Mr. Williams, the London and South-Western Railway

Company's superintendent at Southampton Docks, his appreciation of the arrangements and facilities by which the remarkable celerity above mentioned was attained, thereby enforcing the similar opinion expressed by Lord Kitchener on his return from the South African war as to the very useful part Southampton and the South-Western Railway had played in that conflict. In this instance and in others, the sea-power of our railways is an important part of the fighting strength of the country.

In the food supply of our people the docks provided by our railway companies play a very important part. The London and South-Western, by virtue of its position as dock-owner as well as railway-owner, is able to work the import traffic of Southampton with the greatest possible economy in the matter of handling and loading, and it can thus give exceptionally low rates on shipments for the London market. Similarly the Great Eastern, in its capacity as owner of a fleet of steamships trading with the Continent, can carry Dutch, Danish, and other imports through Harwich with a despatch and at a price which would not be possible were the means of sea and land carriage in separate hands. At the same time, of course, the export traffic of the British Isles is facilitated, as the vessels require back cargoes; and whatever is done by the railway companies in the direction of cheapening freight on exports assists the British trader to scale the tariff walls of the Continent and the United States.

The immense cold storage and lairage premises recently erected by the London and South-Western Railway Company on the open quays at Southampton Docks, and leased by it to the International Cold Storage and Lairage Company, Limited, are eloquent of the importance of Southampton as a food port. The cold store is the largest in Europe. It consists of five floors containing fifty-six rooms, and has a total storage capacity of 2,000,000 cubic feet. 4,800 quarters of beef and 155,000 carcases of sheep can be accommodated at one time, and there will still be 1,300,000 cubic feet available for miscellaneous goods, such as butter, fish, game, poultry, eggs, fruit, etc. In the slaughter-houses and lairages 600 head of cattle can be killed and dealt with per diem, and there are ample means of increasing this accommodation when required. The grain warehouses at Southampton and other ports are also very interesting, possessing as they do automatic machinery for taking corn out of the hold of a ship and depositing it at any required spot in a series of huge warehouses, where men are kept busy at the opening of each spout levelling down the heap of grain which pours out in an everflowing stream. The casual stroller on the quays alongside these grain warehouses is surprised to learn that under his feet this stream of grain is passing, and it is a fascinating pastime to watch the corn being poured through a funnel apparently into the interior of the quay, and then to follow its course from place to place till it comes to rest on its allotted floor in the great series of stores. These are but samples of the extensive facilities of various kinds

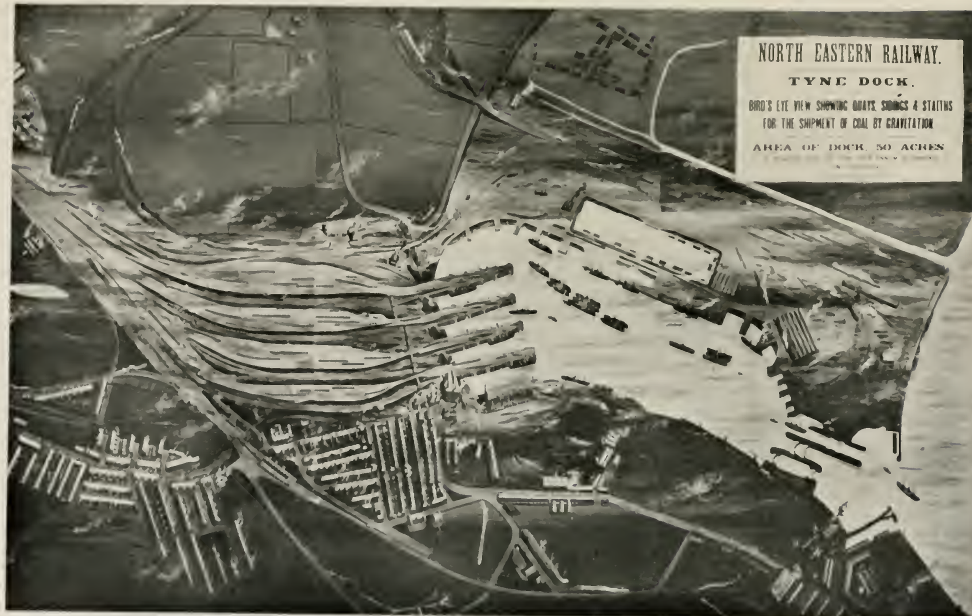
THE WHITE FISH MARKET, MALLAIG HARBOUR, N. B. R.

COAL-TIPS AT GARSTON DOCKS, NEAR LIVERPOOL, L. AND N. W. R.

which railway companies, in the capacity of dock-owners, find it necessary to provide for the reception and handling of import traffic. The provision of graving-docks for repairing ships is also an expensive necessity which railway dock-owners have to supply. The new graving-dock just completed at Southampton is no less than 871 feet long.

Under the head of exports the most important commodity dealt with at railway docks is coal. As already stated, the Taff Vale, Barry, Cardiff, and Rhymney railways of South Wales were primarily built for the development of the most important steam-coal district in the world, the output of which is about 35,000,000 tons yearly. The greater part of this huge output is carried down by these railway companies to the coast, to be shipped at the docks which they have provided for the purpose. At Barry Dock no less than 8,810,127 tons of coal were exported in 1903, and the figures for Penarth and Cardiff (Bute) Docks are also very large, the shipments at Penarth (about four million tons annually) being probably larger in ratio to area than at any other dock in the world. It is claimed that the most efficient machinery in the world for the shipment of coal quickly, so as to secure despatch in the loading and departure of a vessel, is possessed by the Taff Vale Railway Company at Penarth Dock, near Cardiff. The plant referred to consists of four movable hydraulic tips which run on rails like travelling cranes, so that they can all be brought to bear on a vessel at the same time. The loaded wagon of coal, the standard capacity of which is ten tons, runs down by gravity when the hand-brake is released, from an adjacent siding on to the cradle of the tip, and it is immediately raised by hydraulic power to a maximum height of forty-five feet above the quay level. It is then tipped, the pin holding the door at the lower end is removed, and the contents descend through a shoot in the direction of the ship's hold. The South Wales steam coal, however, is very fragile, and to give it a drop of forty-five feet would damage it seriously. Accordingly a most ingenious intermediary, in the form of an "anti-breakage box," has been devised, which is lowered down by a crane to receive the coal at the foot of the shoot, and in which the coal is further lowered until it is in close proximity to the hold of the vessel. This box is made in two parts, so arranged that it opens automatically by the tightening of a chain at a certain stage in the operation of lowering, and closes automatically when raised. The use of the box can be dispensed with after part of the cargo has been loaded, as the heap of coal rising in the hold itself serves to break the force of the fall from the shoot.

When the four movable tips at Penarth are concentrated upon a single vessel, four ten-ton coal wagons can, in the space of thirty seconds, be lifted from the quay, their contents tipped into the shoot, and the empty wagons brought back to quay level. But the operations of feeding the cradle with wagons from the siding on the quay, and boxing and trimming the coal as it falls from the shoot, make it impossible



A RAILWAY DOCK WHERE 7½ MILLION TONS OF COAL HAVE BEEN SHIPPED IN ONE YEAR.
This is a photograph of an isometrical plan sent by the North-Eastern Railway Company to the St. Louis Exhibition, 1904.

to ship a whole cargo at the maximum speed of the tips themselves. The results obtained are, nevertheless, very remarkable. On one occasion a vessel took in 2,333 tons in one hour fifty-five minutes, 1,430 tons being shipped in the first hour, or at the rate of nearly twenty-four tons a minute. At other parts of the dock, where the conditions allow high-level tips to be used, and it is not necessary to raise the wagons by hydraulic power before tipping them, an even greater amount of work can be done per tip. But high-level tips are necessarily fixed; the advantage of the low-level ones is that they are movable, and the whole four at Penarth can be concentrated on to a single vessel.

The coal shipped at Tyne Dock and other East Coast ports is not so fragile as the South Wales product, and the shipping is usually done with hopper-wagons which are run on to staiths or jetties built out into the dock, with four or five loading-spouts on either side of them. The contents of the wagons are then discharged through the hopper-bottoms into the spout, instead of from an end door as at Cardiff. At the Tyne Dock of the North-Eastern Railway Company the striking feature is the complete use made of gravitation for the moving of the wagons on and off the staiths. The wagons are brought from the various collieries by locomotives to the nest of sidings provided for each jetty, from whence they are run on to the jetty by gravitation, and having delivered their load at one of the spouts, they run off the jetty, still by gravity, to the empty wagon standage, on a lower level. The spouts are laid at an angle of fifty degrees, and are constructed in such a way that a ship can be loaded at four different levels, and into two hatches at the same time. The speed at which coals can be loaded is only limited by the trimming in the ship's hold. In addition to shipping seven million tons of coal annually at Tyne Dock, the North-Eastern loads up about three million tons yearly at its Blyth staiths, and about two million tons at Dunston-on-Tyne.

The London and North-Western has some very efficient coal-shipping machinery at its Garston Dock, near Liverpool, as also have both the Caledonian and the North British at their various ports. At the new Grangemouth Dock of the Caledonian Railway Company on the Firth of Forth hydraulic hoists for coal shipment are now being erected capable of lifting wagons of a gross weight of thirty-two tons. This will enable trucks of a capacity of at least twenty tons to be dealt with. The limitations of the dock machinery at the various ports have hitherto been an obstacle in the way of the conveyance of export coal in large-capacity wagons, but the North-Eastern can deal with twenty-ton wagons at Blyth, and the Caledonian is now following suit at Grangemouth. The North-Eastern is now erecting a new dock and a new coal-shipping staith at Hartlepool, and the Cardiff Railway Company has almost completed a new "Bute" dock at Cardiff. The improvements now being carried out at Grangemouth, Hartlepool, Cardiff, and other ports, together with the new dock works about to be started by railway companies at Hull, Grimsby, and elsewhere, emphasise the advantage to our shipping and to trade generally of having the long purses of the railways to draw upon so as to meet the constant need for enlargement of accommodation due to the continual expansion of the size of ships.

CHAPTER XII.

The Legal Department.

IT is a common saying that "a company has neither a body to be kicked nor a soul to be saved"—the moral of which oracular utterance is usually taken to be that it is wise for an individual to avoid disputes with a corporation. Now, our railways are the biggest joint-stock corporations, or companies, in existence amongst us, and yet there is another trite saying that "a railway company is fair game," which, being interpreted, means that smart people can circumvent the railway authorities and turn the weaknesses of the latter to financial advantage in a variety of ways. To a certain extent, railway companies stand above ordinary law, as they are brought into existence each by its own special Act of Parliament, and everything of importance which they do subsequent to their incorporation is done by virtue of further special Acts granted to them by the Legislature. The most important special privilege obtained by an incorporated railway company is the power to purchase compulsorily the land it requires for its lines, stations, and other works; but whereas Parliament compels the landowner to

A RAILWAY SOLICITOR AT WORK.

The late Mr. C. H. Mason was appointed Chief Solicitor of the London and North-Western Railway Company in 1883, at the early age of thirty-two, and held that important office with distinction until his sudden death at the close of 1902. He was distinguished as an athlete as well as learned in the law.

sell his land to a railway, it gives him many opportunities of "putting the screw on" in regard to price; and in a previous chapter I have quoted the dictum of an eminent solicitor that "the acuteness exhibited by the landed gentry as to the means of wringing money from a railway company went beyond anything which he or any other individual could have conceived."

Railway companies, therefore, require the services of legal advisers from the moment of their birth. The highly paid assistance of solicitors, Parliamentary agents, and members of the Parliamentary Bar, is absolutely necessary to obtain the Act of Incorporation giving the initial powers of construction; and so soon as the Bill has been safely piloted through the Committee Rooms at Westminster, the legal gentlemen have their attention turned to the drawing up of the prospectus—if one is required—and to the many formalities which attend the purchase and conveyancing of the land on which the works are to be laid down. It usually happens that a firm of solicitors are amongst the original promoters of a railway project, and if success attends the scheme, to this same foresighted and enterprising firm the valuable legal work of the company subsequently falls. But a railway company in a big way of business requires the undivided attention of quite a number of qualified solicitors, and so in course of time most of the principal companies of the United Kingdom have set up their own legal departments, which hold much the same relation to the general administration as do the departments of the engineer, accountant, surveyor, etc. A few companies—notably the Midland—continue to employ outside firms, but in such cases one of the leading members of the firm does little else but the railway work, and his individual position, and that of his personal staff, in relation to the railway which they serve tends to become much the same as that of the salaried railway lawyers.

The typical railway solicitor of the present day is a salaried officer of the company for whom he works. His offices are at the company's headquarters, he attends there as regularly as do the chiefs of the other departments; and he is present at the meetings of the directors, whenever matters having a legal aspect come up for consideration. And it is astonishing how numerous are the questions arising in connection with railway management as to which legal advice is imperatively required.

We have noted already that every extension of line requires the sanction of the Legislature, in order that compulsory powers for the purchase of the required land may be obtained. A large railway company finds it necessary to promote a Bill of its own almost every Session, as well as most carefully to watch the Bills promoted by other railway companies, tramway and water companies, etc., so as to see that these do not obtain powers to do anything which is likely to be prejudicial to the interests of the particular railway in question. All this involves the maintenance within the railway solicitor's department of a special sub-department devoted exclusively to Parliamentary work, and having an office in the neighbourhood of Westminster, where during the Session, and at the time for depositing Bills—November—its chief activities are carried on.

This Parliamentary work is a very special branch of the legal industry. It does not demand a very profound knowledge of law, but it does require an intimate acquaintance with intricate and elaborate forms of procedure, as well as much skill in strategy and insight into human nature, as personified by the well-bred and well-groomed gentlemen who, in batches of four or five, constitute the special Committees for dealing with railway Bills. The chief solicitor of a railway company always selects the Parliamentary work as matter for his close personal attention. When the Committees are sitting, a dozen or more railway lawyers with their satellites are constantly to be seen flitting about the corridors, or sitting watching the progress of the Bills in the several rooms. Nor do the hours when the Committees sit by any means embrace the whole of the time which Westminster demands of railway solicitors during this their busiest season of the year. There are usually consultations to be held with Parliamentary agents and counsel both before and after the meetings of the Committees, and all the time the chief railway solicitor is conscious that a batch of papers dealing with the current, every-day work of his department is accumulating at his headquarters office, and wondering when he will get a few quiet hours away from Westminster to attend to his multifarious other duties.

Of the members of the Parliamentary Bar there are quite a number who devote themselves mainly to railway work, and whose incomes from their profession would be very much less than they are, were it not for the handsome fees marked on the briefs which they receive from the solicitors of the great railway companies. Amongst eminent barristers who have won fame and fortune by their successful pilotage of railway Bills through Committee may be mentioned the late Lord Grimthorpe (who was known at the Parliamentary Bar first as Mr. Denison, and then as Sir Edmund Beckett, before he attained a peerage on his retirement), the late Mr. Samuel Pope, Mr. C. A. Cripps, Sir Ralph Littler, Mr. Pember, Mr. Balfour Browne, Mr. Ernest Moon, Mr. Honoratus Lloyd, and Mr. Ernest Page. Sir William Harcourt also practised at the Parliamentary Bar in his younger days and held many railway briefs. The Parliamentary Bar is a very close corporation, and it is exceedingly difficult for a new-comer to obtain recognition. But if a chief railway solicitor takes up a young man of ability and briefs him frequently, his fortune is made. Both Lord Grimthorpe, who was leader of the Parliamentary Bar some twenty years ago, and Mr. Ernest Moon, who is one of its brightest ornaments at the present day, had the advantage of being sons of chairmen of railway companies—Sir Richard Moon and Sir Edmund Beckett Denison, being the men, above all others, who made

THE RAILWAY AND CANAL COMMISSION COURT AT WORK.

This drawing was made at the Royal Courts of Justice on the 24th of January, 1905. The matter at issue at the time was whether a certain rate for mineral traffic over a portion of the Great Central Railway should be 2s. 1d. or 1s. 9d. per ton. Mr. S. Fay, General Manager of the Great Central, is in the witness-box. The Commissioners are (from left to right) Sir F. Peel, Mr. Justice Bigham, and Lord Cobham.

the London and North-Western and Great Northern Railways, respectively, the great undertakings they are to-day.

Parliamentary agents come very little before the public, and the nature of their work, which is very largely of a technical and formal character, is not such as to appeal to the popular imagination. Here again the business is in the hands of a comparatively few men, and new firms find it difficult to obtain an *entrée* into what is probably one of the most lucrative, as it is one of the most select departments of the legal profession. The veteran Sir Theodore Martin, who wrote the "Life of the Prince Consort" and married Helena Faucit, is the *doyen* of Parliamentary agents. He came to London from Edinburgh in 1845, and has worked at Westminster in the passing of private Bills from that date until the present time (1905).

In addition to their work in the Committee Rooms at Westminster, eminent members of the Parliamentary Bar obtain a good many briefs to represent railway companies in the Court of the Railway and Canal Commission, which sits several times a year at the Royal Courts of Justice in London, and also holds sittings in Edinburgh and Dublin. This tribunal, as stated in a previous chapter, has been specially constituted by the Legislature to deal with disputes arising between railway companies and their customers under the Traffic Acts, and also with controversies between one railway company and another as to through traffic passing over more than one system. Sir Frederick Peel has been a member of this Commission since 1873, and, although over eighty years of age, he still brings an acute intellect, combined with unequalled experience, to bear upon the many complicated problems which come up for decision before it. The other permanent member of the Commission, until 1905, was Lord Cobham, a member of the very clever and distinguished Lyttelton family, but he has now retired in favour of the Hon. A. E. Gathorne Hardy, a barrister and (like Lord Cobham) an ex-railway director. The Court is presided over by a judge in each country, who forms the third and chief member of the Commission. Its president for England is Mr. Justice Bigham, the judge who tried the ill-fated Whitaker Wright. Mr. Justice Wills, Sir Richard Henn Collins (the Master of the Rolls), and the late Mr. Justice Wright have also been English presidents of the Railway Commission, and it is worth noting that all of these eminent lawyers gained experience as counsel for railway companies at the Bar before being appointed to the Bench.

The work to be done in the Parliamentary Committee Rooms and before the Railway and Canal Commission is usually the personal care of the chief solicitor of a large railway company, besides which he generally has several important arbitration cases with rating authorities, contractors, or other railway companies every year, which, from their special character, require his individual attention. The business of the Conveyancing and Common Law sections of his department, as a rule, is of a more ordinary character, and can be entrusted to experienced assistants, working, of course, under the supervision of, and in constant consultation with, their chief. Probably there are about a dozen "admitted" solicitors in the legal department of a great railway company, and, of course, each of these has to have his staff of clerks and messengers, so that the whole department is quite a large one.

The conveyancing office, as its name implies, deals with all matters arising out of the purchase of land for the purposes of the railway. The number of deeds which passes through the hands of this section of the legal staff of a great railway is enormous; and, of course, every document forming part of the company's title to its widely scattered property has to be carefully preserved. It is therefore necessary for every large railway company to have a "muniment-room," or fireproof apartment, in which these deeds may be stored. Some of them are very ancient documents, going as far back as the sixteenth century, and the muniment-room, with its glass-covered oak cases, resembles a miniature British Museum, while its heavy steel doors give it the appearance of a magnified safe. There are between 70,000 and 80,000 deeds carefully stored, arranged in geographical divisions, and indexed, in the muniment-room of one of the largest English railway companies.

The work of the Common Law section of the legal department of a great railway company is very varied, and it takes railway solicitors into all grades of courts, from petty sessions to the House of Lords. One day they may be answering a summons before a stipendiary in London for creating a smoke nuisance, or prosecuting a passenger for travelling without a ticket, and the next they may be fighting an epoch-making suit through the highest courts, such as the famous case of the Taff Vale Railway company *versus* the Amalgamated Society of Railway Servants, which has affected the position of every trade union in the United Kingdom by making their funds liable for penalties arising out of illegal acts on the part of their agents. As the result of this historical case, a cheque for £23,000 was paid by the Amalgamated Society to the Taff Vale Railway Company in settlement of damages and costs.

A great deal of the work of the Common Law section of a railway solicitors' office arises out of claims made upon railway companies for personal injuries to passengers, or damage or loss of freight. Under an Act of 1846, which is known as "Lord Campbell's Act," railway companies are liable to give compensation in cases of death, provided it can be proved that the accident was occasioned by negligence on the part of their servants. They are also liable at Common Law for personal injury by accident so occasioned. In the majority of cases the negligence is admitted, and the negotiations resolve themselves into a question of fixing the amount of the damages—not by any means an easy matter, however. In some instances, on the other hand, the accident is judged, in legal phraseology, to have been "an act of God," and the unfortunate sufferers are debarred from legal redress. Many years ago, on the Great Northern main line, a train was thrown off the track, a number of passengers being killed and others injured. The company disclaimed liability, and a whole series of actions were brought, at least one of which was tried by Lord Campbell himself. It was proved that the damage to the line which caused the accident was due to the action of flood-water, and not one of the sufferers obtained a penny of compensation. It is related that Lord Campbell became so impatient at the indecision of the jurymen who tried one of these cases that, by way of stimulus, he reminded them that in days gone by they would have been liable to be "taken in a cart to the county boundary and thrown into a ditch."

To illustrate the other side of the operation of Lord Campbell's Act, I may perhaps be excused for repeating another incident which I record in my "History of the Great Northern Railway"—the case of Miss Warren, at Spalding station. This lady, a dancing-mistress, had tripped over a hole in the carpet of the station waiting-room, sustaining thereby an injury to her spine; and, although the company brought evidence to show that there had been no hole in the carpet in the morning early, and that it had probably been kicked open the same day by "some gentleman with thick boots"—"it is a farming district," their general manager explained in his evidence—Miss Warren was awarded compensation to the amount of £1,500. This case was quoted in

Parliament at the time as an argument for an amendment of the law.

One important railway company some time ago had a case of a woman who was hanging her washing over the railway wall at the end of her garden, when a big stone on the top of the wall fell down and injured her foot. She claimed damages from the company on the score of their negligence in allowing large, loose stones to lie on the top of their wall. Needless to say, liability was denied, and the woman went to law and lost her case.

"Faked-up" claims against railway companies, in connection with injuries alleged to be sustained in accidents on the lines, are of common occurrence. In one instance a cattle-drover brought an action against a great railway for a shock he stated he had sustained in one of their trains; and he hobbled into the witness-box on crutches, apparently in great pain. Serjeant Ballantine was counsel for the defence, and the investigations of the railway solicitor had placed in his hands some correspondence in which the plaintiff admitted that his suit was a "put-up job," and promised to share the plunder with the confederate to whom he was writing. By skilful cross-examination the serjeant led on the drover to admit the authorship of some of the letters; but when he was about to be confronted with the signature to the one in which the attempted fraud was revealed, the plaintiff simply bolted from the witness-box, throwing down his crutches; and he was heard of no more!

A GRUESOME RAILWAY CONSIGNMENT WHICH LED TO A LAWSUIT.
The Perrvian mummy which was mistaken for a corpse.

A RAILWAY BOUNDARY WALL WHICH FIGURED IN THE COURTS.
One of the large stones on the top of this wall fell on the foot of a woman, who unsuccessfully claimed damages from the railway company.

In one of the most extraordinary of these cases of simulated injury the plaintiff was a negro. Presumably by some trick unknown to the medical lore of Europe, he managed to assume a ghastly hue, which can only be described as a livid green, and medical men and lawyers were alike deceived. Within a week after the payment to him of a substantial sum as compensation for what were supposed to be incurable injuries, the black man decamped, and he was never seen again. To prevent such a fraud as this, it would be advisable if compensation for personal injuries were payable as an annuity instead of in a lump sum, so that in case of rapid recovery the railway company might have an opportunity of having the amount of the award revised.

One of the most remarkable cases of attempted fraud upon a railway company, in connection with "bogus" personal injuries, was tried in 1904, and resulted in the claimant being prosecuted for perjury and sentenced to a term of hard labour. Out of hundreds of people travelling by a certain train from Euston on a Saturday afternoon, there was only one—a middle-aged man—who complained of injury in connection with a slight bump occasioned by shunting operations. Had he been content to claim moderate compensation, he would probably have been successful, for the "bump" undoubtedly occurred, and his injuries were very cleverly simulated. But he estimated his damages at the high figure of £5,000, supporting his claim by statements as to the large income he had been making in various businesses, to which he was no longer capable of attending. Enquiries into his commercial career had consequently to be instituted by the solicitor's department of the London and North-Western, with the result that an extraordinary story of bankruptcy, fraud, and deceit was unfolded. When the trial came on at the High Court, the plaintiff's evidence-in-chief was absolutely torn to shreds in cross-examination, and the jury dismissed his suit without hearing the witnesses for the railway company. A warrant for perjury was promptly obtained, and a few days later the man was arrested just as he was leaving his home at Brighton to embark for America. He was tried at the Old Bailey, found guilty by the jury without their leaving the box, and sentenced by Mr. Justice Bigham to nine months' hard labour—certainly not a severe sentence, considering that his action had cost the London and North-Western Railway Company over £1,000, and had engrossed almost the whole attention of their assistant Common Law solicitor and his staff for many months.

In connection with this case, it may be interesting to state that every large railway company keeps a staff of detectives whose services are requisitioned to "shadow" individuals who are suspected of having made bogus claims. In bringing the above-mentioned criminal to justice, the work of the North-Western's detective staff played a very important part, as his movements were carefully watched day by day for many months. So it came about that when the perjury trial came on, the company's counsel was able to tell the jury a good many surprising things about the doings of a man who was supposed to have been a confirmed invalid ever since the date of the "accident." On the very same night after the alleged "shattering of his nervous system" he had assisted a lady friend to move from one set of lodgings to another, had spent the night of the "accident" at her new rooms, had amused the baby and had apparently taken part in the mysterious disappearance of the contents of a bottle of whisky, which had been sent out for in the evening, but was found empty on the following morning. These and many other details, inconsistent with the man's account of his serious injuries, were reported by the railway company's detectives, and their recital made a great impression both at the civil and criminal trials.

In connection with damage to, or loss of, goods in transit, many claims are made against railway companies, and whilst those are promptly settled which appear to be *bonâ fide*, many such cases become the subjects of actions in the courts. One of the most remarkable cases of this kind was that of the Peruvian mummy, to which I referred in a previous chapter, when dealing with the singular character of some of the traffic carried over our railways. It will be remembered that in this instance the mummified remains of a Peruvian Inca *en route* for a Belgian museum were mistaken by the railway officials for a corpse; and, the police having been called in, an inquest was actually held over this gruesome consignment. The jury returned a verdict in accordance with the evidence placed before them, but added a rider to the effect that "the occurrence did not point to any recent crime having been committed in this country." The consignor of the mummy, a scientific lady, subsequently sued the railway company for damage to her treasure trove —which arrived at the museum in a sadly soiled condition—and a small sum was awarded to her as compensation.

A case of another kind which occurred in Westmoreland illustrates the difficulties which railway lawyers sometimes find in securing proper verdicts from country juries. The railway company in this instance was sued for the value of a horse which, never having seen a train before, took a flying leap over the retaining wall when it was first brought into the sight of a railway, and met its death, in the manner predicted in regard to the famous "coo" by George Stephenson, by attempting to charge an oncoming train. On the application of the railway solicitor the judge said there was no case of negligence to go before a jury, and dismissed the suit. Subsequently the legal representative of the railway got into conversation with a member of the jury at the neighbouring hotel, and he happened to remark that the case was so clear that had the action gone on, the result must have been the same. "Eh, mon," was the reply, "ye dinna ken a Westmorland jury!"

The above anecdotes could be multiplied almost to an unlimited extent. Those I have given, however, are sufficient to show how varied is the work of a railway solicitor on the Common Law side, and how constantly he has to be on the alert to circumvent the ingenuity of that considerable section of the public who consider a railway company "fair game," and who are constantly hatching new schemes for diverting into their own pockets some of the large revenues which go towards making up the dividends of railway shareholders. The biggest fraud on record ever perpetrated on a railway company, however, was the work not of a member of the public, but of one of their own officials. I allude to the notorious case of Leopold Redpath, head of the registration department of the Great Northern Railway Company, who pocketed a sum exceeding £200,000, by creating fictitious stock in the company's registers, and selling it through brokers on the Stock Exchange. Perhaps the most remarkable feature of this case was that for years before the discovery of his crime Redpath was known to be a very wealthy man, keeping up several large establishments, entertaining lavishly, and giving large sums to charities. And yet he appeared eager to retain his position under the Great Northern, the salary of which was no more than £250 a year! He was sentenced at the Old Bailey on 16th January, 1857, to transportation for life, and was one of the last to undergo that now obsolete punishment. In conjunction with Mr. (now Sir Henry) Oakley, my father, the late Mr. William Grinling, then and long afterwards an official of the Great Northern, was largely instrumental in bringing this extraordinary "Redpath fraud" to light.

CHAPTER XIII.

Railway Towns.

ONE of the most striking features of railway development in the United Kingdom, is the way in which large bodies of men, engaged in the service of a single company, are grouped together so as to form, in several cases, the majority of the male population of the town in which they reside. Such towns as Swindon, Crewe, Wolverton, Horwich, and Eastleigh owe their existence, indeed, to the fact that they are great railway centres; whilst others, like Derby, Doncaster, York, and Gateshead, have taken on a new character since railway headquarters were established in their midst. Swindon, where the locomotive-, carriage- and wagon-works of the Great Western are situated, has grown in sixty years from a village into a corporate town of 50,000 inhabitants, 13,000 of which are in the direct employ of the railway company, whose wages bill at this centre alone amounts to £16,000 per week. The centre of the educational and social activities of the town is the "G.W.R. Swindon Mechanics' Institution," which was "instituted on the 8th day of January, 1844, for the

THE LARGE READING-ROOM, MECHANICS' INSTITUTION, SWINDON, G. W. R.
Photo by Protheroe & Simons, Swindon.]

THE CONCERT-HALL AND BALL-ROOM, MECHANICS' INSTITUTION, SWINDON, G. W. R.

Photo by Protheroe & Simons, Swindon.]

purpose of disseminating useful knowledge and encouraging rational amusement amongst all classes of people employed by the Great Western Railway Company." In pursuance of these objects, it provides circulating and reference libraries, reading-rooms—one of which, the newspaper-room, is probably the finest of its kind in the country—rooms for billiards, chess, draughts, and other games, a large hall for musical, dramatic, and other entertainments, a lecture-hall, in which series of popular lectures are annually given, and class-rooms for educational purposes. The subscription for Great Western men ranges from fourpence to tenpence per month, while persons not employed by the company are admitted on annual payments ranging from five shillings to twelve and sixpence. Lady members are welcomed, not only from amongst the female *employés* of the company, but also relatives and friends of the male servants ; and a special ladies' reading-room is provided, which is furnished and equipped to suit the feminine taste.

In addition to the varied and constant everyday work of the institute, there are two great annual functions arranged under its auspices. The one is the juvenile *fête*, and the other the annual trip. The former is held in the Park—the gift of the railway company to the town—and usually takes place in August. A small charge is made for admission, and a "bumper" programme of attractions provided throughout the afternoon and evening set aside for the gala. There are stage performances at frequent intervals, a liberal programme of music by a first-class band, and a grand display of fireworks to wind up the day. Refreshments are provided free for the children, and the supply for 1904 included no less than three tons of cake, each portion of which weighed 5 lb. and measured $8\frac{3}{8}$ in. by $5\frac{1}{8}$ in. by $5\frac{1}{4}$ in.

The annual trip usually takes place in July, and is the biggest thing in the way of excursions done in this country. By the generosity of the railway company, there are free trains in all directions, and everybody who can possibly leave home joins in the trip. Last year no less than 23,145 persons took part—13,401 adults and 9,744 children. There were three trains to Weston-super-Mare, five trains to Weymouth, three trains to London, one train to Winchester, one train to Birkenhead *viâ* Worcester and Chester, and another to Manchester *viâ* Birmingham and Crewe, three trains to South Wales, and four trains to Exeter, Newton Abbot, and Plymouth, making a total of twenty-one special trains in all, leaving Swindon between 4 a.m. and 7 a.m. on that eventful July morning. Some of the passengers returned the same day, others stayed away as long as a week, and all travelled free, provided they conformed to the regulations and used only the trains specified in the programme. Whatever may be the drawbacks of life in a railway town—and it cannot be said that such places are ideal for permanent residence—the opportunities which railway *employés* enjoy of getting away from home are unique. Apart from such special excursions as the Swindon annual trip, all servants of railway companies throughout the United Kingdom, with a few exceptions, enjoy the advantage of being able to obtain privilege tickets over the lines of any company affiliated to this scheme at one-quarter the ordinary fare. The salaried staff also receive free passes for their annual holidays.

Another most beneficent institution at Swindon is the G.W.R. Medical Fund Society, which has no less than eleven doctors on its staff, besides a dental surgeon, an assistant dentist, and seven dispensers. There is a well-appointed cottage hospital in connection with this society, which also owns a commodious dispensary, washing and Turkish-baths, swimming-baths, hairdressing and shaving-saloons, and a dentistry, and provides invalid-chairs for the benefit of its members. Subscriptions are also made through the funds to a number of hospitals and convalescent homes. Membership of this society is compulsory upon *employés* of the Great Western Railway Company in the town, and it is managed on a self-supporting basis by a committee of the members. It was established as long ago as 1847, and has done an incalculable amount of good work.

The London and North-Western Railway Company differs from the Great Western in not concentrating its plant works in a single centre. There are not one, but three "railway towns," on the North-Western system—*viz.*, Crewe, in Cheshire, where the company's locomotive and steel works are situated; Wolverton, in Buckinghamshire, the site of the carriage works; and Earlestown, in Lancashire, where are the wagon shops. Crewe Works were established in 1843, when the Grand Junction Railway Company's works were transferred thither from Liverpool, prior to which time the whole area now occupied by the town and works of Crewe was agricultural land. In 1844, the railway company provided the men with a library and reading-room, and gave a donation to purchase books. In 1845, this movement developed into the Crewe Mechanics' Institution, the management being vested in a Council, elected annually, of representatives nominated by the directors and members conjointly, and this system of electing the governing body has continued ever since. The original building of the institution was removed in 1846, and a larger edifice built by the company in its place, and this has been added to from time to time until it has reached its present dimensions.

The population of Crewe in 1846 was only a few hundreds, now it is upwards of 40,000. The men employed in the works were then 161, now they number about 8,000, besides large numbers of men employed in other departments of the railway company's service. It was in 1846 that the Grand Junction Railway was amalgamated with the London and Birmingham and Manchester and Birmingham Railways, under the title of the London and North-Western Railway. In 1849, evening classes for teaching reading, writing, arithmetic and mechanical drawing were formed in connection with

THE MEDICAL FUND SOCIETY'S DISPENSARY, SWINDON, G. W. R.
Photo by Protheroe & Simons, Swindon.]

THE LIBRARY, MECHANICS' INSTITUTION, SWINDON, G. W. R.
Photo by Protheroe & Simons, Swindon.]

the Crewe Mechanics' Institution. These classes were added to from time to time, and they now cover the whole range of mechanical science and art, and all commercial and technological subjects applicable to the trade of Crewe. Nearly all the teachers of the various subjects taught at the institution are engaged in Crewe Works, and so have a thorough practical knowledge of what they teach to the students. Many of the teachers have received their education at the institution, and have been winners of important scholarships. It is evident, from the successful results obtained by the students, that the teaching has been of a high quality.

To keep pace with the growing demand for technical instruction, the directors of the London and North-Western Company have recently provided at Crewe an electrical engineering laboratory, equipped with all appliances necessary for teaching electrical engineering, and have arranged for a number of the apprentices in the works to spend one afternoon per week in this laboratory, in order to receive instruction, at the same time paying their wages for the time thus occupied as though it were spent in the works at their ordinary duties. This laboratory is also utilised for evening-class students of the institution. A mechanics' shop is also attached, containing lathes, drilling machines, etc., worked electrically. The object of the company in establishing the Mechanics' Institution was primarily to give their young workpeople the advantage of a good education, so that they could be taught theory at the institution while they learned the practical part in the works. Membership of the institution has, however, always been open to non-*employés* resident in the town. The fees charged are merely nominal, and this is owing to the financial support contributed by the company, which is mainly derived from a portion of the entrance fees paid by apprentices (not the sons of *employés* in Crewe Works) for admission into the works, the sons of *employés* being allowed free admission. The Crewe institution receives national grants for educational results, but no grant is received from the local authorities, as the Cheshire County Council, the administrative authority, makes it a condition only to give grants where representation is allowed, and up to the present time the directors of the company have objected to any outside interference with the detailed working of the institution.

In 1855, in order to encourage students, the directors of the company gave a donation of £20 to be awarded in books, etc., as prizes for literary and scientific attainments, to servants of the company under twenty-one years of age employed in the locomotive department, and this amount has ever since been contributed annually for that purpose. In 1888, the late Mr. Bartholomew Kean, an official of Crewe Works, left by will the sum of £8 annually, to be distributed as prizes to youths under twenty years of age employed in Crewe Works. In addition to these prizes, the late Mr. Ramsbottom, a former chief mechanical engineer of the company, and the late Sir Richard Moon, who was chairman of the company, endowed scholarships in 1874 and 1891 respectively, to be awarded to young men employed in the London and North-Western Railway Company's works, and these scholarships are, therefore, open not only to Crewe students, but also to the competition of students employed in the company's works on other parts of the London and North-Western system, such as the Wolverton Carriage Works and the Earlestown Wagon Works, at which places there are similar mechanics' institutions to that of Crewe, supported by the company. County Council scholarships, offered to the students in Cheshire schools, are also frequently gained by students of the institution; whilst scholarships such as the "Whitworth," "Royal," and "National," open to general competition in the country, are also competed for by the students, who have been successful in gaining many of them. The "Whitworth" scholarships, founded in 1869, may be considered the "blue ribbon" prizes of scholastic mechanical engineering, and since 1872, when the first of these was secured by a student of the institution, fifty-two "Whitworths" have been won by the students of the institution, all of whom were employed in Crewe Works.

The Crewe Institution is affiliated with the Union of Lancashire and Cheshire Institutes, the City and Guilds of London Institute, the Society of Arts, and the Board of Education. Each of these bodies holds examinations in various subjects, and awards prizes and certificates. The library in connection with the institution contains about 12,000 volumes, and to these new works are constantly being added. A patent-specification library is also maintained for reference by inventors. The news-room of the institution is supplied with all the chief newspapers, periodicals, and magazines published in the country, and telegrams of the latest news are received and posted up there throughout the day. Coffee, smoking, and recreation-rooms are also provided for the members.

In 1863, the London and North-Western Railway Company established a small hospital at Crewe, there being no public institution of the kind within twenty miles of the place. The premises were extended from time to time, and in 1900 an entirely new hospital was built, with accommodation for sixteen in-patients. This hospital, which is situated inside the works, is entirely supported by the company, and the *employés* do not contribute towards its maintenance nor pay any fees as in-patients. The London and North-Western Company also gave a site outside their works for the Crewe Memorial Cottage Hospital, and subscribed towards its endowment fund.

As a general rule, the houses in railway towns are not owned by the companies, it having been found better to leave the provision of dwellings for the workmen to private enterprise. The Glasgow and South-Western Railway Company, however, has built a model village at Corkerhill for its locomotive staff,

THE RAILWAY PARK, CREWE, L. AND N. W. R.

THE MEMORIAL COTTAGE HOSPITAL, CREWE, L. AND N. W. R

where a population of about 800 people is lodged in eleven blocks of houses, the total number of separate dwellings being 120. Allotment gardens are also provided by the railway company, and an institute similar to those already mentioned. At Crewe, the London and North-Western has built and owns over 800 houses, and the Great Western has about 300 at Swindon. This is also about the number owned at Wolverton and Earlestown by the North-Western, which also has over 250 at Willesden and 120 each at Rugby and Watford. Altogether the last-named company has 5,152 houses and cottages occupied by members of its staff, the majority of which are let at rentals of from one shilling and sixpence to four shillings and sixpence a week. The privilege of living in a company's cottage is very much valued. Preference is, of course, given to such men as it may be necessary to call up in cases of emergency—the cottages being in close proximity to the lines—and in ninety-five cases on the North-Western there is electric-bell communication between the nearest station, or signal-box, and the cottage, so that the occupant thereof can be summoned to act as "fog-man," or join a breakdown gang, at a moment's notice. Station-masters, too, are generally housed by the companies.

It is impossible within the scope of an article of this kind to make detailed mention of all the various institutions and societies which exist at great railway centres. Educational and social institutes similar to the ones already described are to be found at Wolverton and Earlestown (London and North-Western Railway), at Derby (Midland), at Stratford (Great Eastern), at Eastleigh and Nine Elms (London and South-Western), at Horwich (Lancashire and Yorkshire), and elsewhere. An interesting feature in connection with the Great Eastern Works at Stratford is the provision of a dormitory for the use of drivers and firemen who have come from a distance and require rest before returning to their engines. This dormitory, which is lighted throughout by electricity, is capable of accommodating, in separate cubicles, fifty men at one time, and it has had over 245,000 bed-occupants up to the time of writing. There are also bath-rooms, a smoking and reading-room, dining-room, kitchen, and clothes-drying-room. Mess-rooms, it should be stated, are provided at all large railway works, where the men can get their midday meal cooked and eat it in comfort. The dining-room erected by the Lancashire and Yorkshire at Horwich will accommodate 1,200 men, whilst this company has also provided an institute *café* for the clerks, etc., at Horwich, where cooked meals may be purchased at net cost prices. At the large railway centres in London there is usually a clerks' dining club. At King's Cross (Great Northern) this institution includes billiard and reading-rooms, to the equipment of which the company has contributed, as well as providing the premises. The North-Western has done the same at Euston. Railway parks are to be found at Crewe and at Horwich, as well as at Swindon, and cricket, football, rowing, bowling, and tennis clubs have been formed at most of the centres—in some cases on recreation-grounds provided by the companies.

Horwich, in Lancashire, and Eastleigh, in Hampshire, are two of the youngest of our railway towns, neither of them being yet twenty years old. When the Lancashire and Yorkshire Company's mechanical engineering works were established at Horwich in 1887, the population was under 4,000; now it is about 16,000, of which 10,000 to 11,000 are probably dependent upon the employment provided by the railway company, the remainder being occupied either as shopkeepers or at the cotton-mills and brickworks, which were in existence before the erection of the railway works. The number of actual *employés* of the railway company is nearly 4,000, and with the exception of eight houses occupied by officers of the company, these all live in houses not belonging to the railway property. A similar state of things exists at Eastleigh, as the railway companies in each case found that private enterprise was sufficiently alert to provide the additional housing accommodation necessary by the time the railway works were ready for occupation.

At both Horwich and Eastleigh the railway authorities have interested themselves keenly in providing technical education for their *employés*, and admirably equipped institutes exist at both centres. The Horwich institute was built by means of a grant of £5,000 made by the Lancashire and Yorkshire shareholders, supplemented by the gifts of an additional wing and mechanical and engineering laboratories by Mrs. Samuel Fielden, of Todmorden, the widow of a director. Another director, Mr. Henry Yates Thompson, generously established a cottage hospital, whilst Mrs. Fielden has also built and endowed a covered gymnasium in connection with the institute. The large hall of the institute is fitted up as a theatre, in which entertainments and lectures are given. In 1890, about eleven acres of land were placed by the railway company at the disposal of the institute committee, who, with financial assistance from two of the directors (Messrs. H. Y. Thompson and W. Hinmers) laid it out as a recreation-ground, with which are associated cricket, football, bowling, and tennis clubs, all connected with, and governed by, the institute.

Eastleigh, though it has grown in fifteen years from a village into a town of 9,000 inhabitants, is likely to become a much more important railway town in the near future. At present its activities are limited to the building and repairing of the carriage and wagon stock of the London and South-Western Railway Company, but a few years ago the company acquired an area of about 200 acres adjoining the existing works, on which the construction of locomotive shops has been commenced. When these are finished, about two thousand more men, with their families, will be removed from Nine Elms, London, where the locomotive works of the company are at present situated. The authorities of the South-Western have already had experience of how to

WORKMEN'S COTTAGES, HORWICH, ADJOINING MECHANICAL ENGINEERING WORKS, L. AND Y. R.

INTERIOR OF WORKMEN'S DINING ROOM, HORWICH, L. AND Y. R.

manage a large migration of this kind, as fifteen years ago, when the present Eastleigh works were established, the men employed in the carriage and wagon shops had to be transferred from Nine Elms. The change will, of course, have to be made gradually, as the work of the locomotive department must be kept going all the time. When this transfer is completed, the Great Eastern will be the only large railway company having its plant works in the neighbourhood of London, and the removal of these from Stratford to a country centre is probably only a question of time. It may be stated that the Great Eastern Railway Mechanics' Institution at Stratford New Town is one of the best in the country, being thoroughly equipped both for educational and social purposes. The number of persons employed by the Great Eastern at Stratford exceeds 4,000, and it would be a serious thing for the locality should high rates and other local circumstances drive the company to remove its works elsewhere.

The numerous differences of creed existing in the United Kingdom have made it difficult for the railway companies to interest themselves, as such, in the provision of churches or chapels for the inhabitants of the towns called into existence by their activities. At Doncaster, fifty years ago, the directors of the Great Northern went so far as to promote a Bill in Parliament to empower the company to build a church, as well as schools, the then chairman of the railway declaring that he could not be content to see the children of the great population brought there in the company's service, running about the streets without having in a week a school to go to, or on Sundays a church for worship. The schools were built out of the company's money, but great opposition was raised at the shareholders' meetings to the church scheme, and eventually the Bill was withdrawn. A subscription was, however, opened amongst the shareholders who approved of their chairman's proposal, and in 1858 the edifice known as St. James's Church, Doncaster, was opened. It has ever since been locally known as "the Plant Works Church." At Crewe, Wolverton, Earlestown, and other places, the London and North-Western Railway Company has very largely subscribed towards providing churches and chapels for its *employés*. At Corkerhill—the Glasgow and South-Western Railway Company's model village above referred to—religious services are conducted every Sunday in the large hall of the railway institute by ministers of churches in the vicinity and by members of the Railway Mission, a society whose object it is to minister to the spiritual needs of railway workers, and which is represented by one or more missioners at most large railway centres. There is also a Sunday-school at Corkerhill, with an average attendance of 110 children, and a Bible-class for young men and women, with an average attendance of 70.

MECHANICS' INSTITUTE AND TECHNICAL SCHOOLS, HORWICH, L. AND Y. R.

RAILWAY INSTITUTE, CORKERHILL MODEL VILLAGE, G. AND S. W. R.

CLERKS' AND WORKMEN'S CAFE, HORWICH, L. AND Y. R.

CHAPTER XIV.

THE CHRISTMAS TRAFFIC; THE PARCELS DEPARTMENT.

ONE often hears the remark that "the old-fashioned Christmas is a thing of the past." Certainly times have changed since Charles Dickens wrote his "good-humoured Christmas chapter" of Pickwick, and the novelist himself observes in the heading to that chapter that the "good customs" therein recorded, "are not quite so religiously kept up in these degenerate days." The writings of Dickens did much to revive and strengthen those old customs; but at the very time when he was producing the "Pickwick Papers," a new force was taking shape in the world by which every social habit of the people was destined to be profoundly influenced. "Pickwick" was published in 1837; the London and Birmingham Railway—our first trunk line—was opened in 1838. At the very moment when Dickens was penning his Christmas chapter, the death-knell was sounding of "the Muggleton coach," upon which Mr. Pickwick and his friends made their never-to-be-forgotten journey to spend Christmas with old Wardle and the fat boy at Dingley Dell, "well wrapt up in great-coats, shawls, and comforters," and accompanied by a "huge cod-fish—snugly packed up in a long brown basket with a layer of straw over the top," half-a-dozen barrels of "real native oysters," and Mr. Weller. "The guard and Mr. Weller disappear for five minutes, most probably to get the hot brandy and water, for they smell very strongly of it when they return; the coachman mounts to the box, Mr. Weller jumps up behind, the Pickwickians pull their coats round their legs and their shawls over their noses, the helpers pull the horse-cloths off, the coachman shouts a cheery 'All right!' and away they go."

Times have indeed changed in those sixty-seven years, but Christmas is still Christmas, though "the Muggleton Telegraph" no longer "rattles through the ill-paved streets." The scene at a great railway-station any hour of the days immediately preceding the great festival is, I venture to think, not one whit less suggestive of "the spirit of Christmas present" than were the incidents of the old coaching days. The meetings of friends long severed—boys and girls coming home from school, young men and maidens returning from scattered fields of work—the Christmas hampers gorging the platforms and piled high on the vans; the snow which has fallen in Scotland the same morning still unmelted on the roofs of the carriages newly arrived in the London terminus; the departure of the outward-bound night train from the opposite platform, the passengers composing themselves to sleep in their snug berths with the knowledge that, when Christmas morning breaks, they will waken to the sight of beloved faces at some far northern station, whilst the driver and fireman prepare for a long and anxious night's ride through frost or snow or driving rain, every minute bearing them a mile farther from their own fireside and quiet home. These are but the bare outlines of a picture which the pen of a Dickens might make to live before us. In the hands of the present writer the theme must fall to a lower level, my object being to supplement the information given in the previous chapters of this volume by some account of the special work which falls upon our railway companies at Christmas-time in consequence of the absolute dependence of the modern world upon means of transport alike for daily food and for nearly all the special comforts associated with the great festival of the year. Christmas, also, being the great season of family reunion, the passenger traffic of our railways is specially heavy at this season.

Let me, first of all, quote a few figures—kindly got out specially for this chapter by railway officials —to show the magnitude of the business which has to be done. On the four days preceding Christmas, 1903, nearly 100,000 tickets were issued at the Waterloo Station of the London and South-Western Railway, that number being, of course, exclusive of season tickets, return "halves," and tickets taken at the company's various town offices, a very large number of all of which were undoubtedly used by passengers on these same days. In the course of an ordinary day there are about 1,000 trains and engines worked into and out of Waterloo, the busiest time being between 5.30 p.m. and 6.30 p.m., when no less than thirty-two passenger trains, heavily laden, are despatched within a single hour. On the 23rd and 24th of December, 1903, the magnitude of the bookings necessitated the running of most of the main-line trains in duplicate, in addition to which a number of "special excursion" trains were despatched to the West of England. This added about fifty more trains to the ordinary daily total, each of which had to be got into and out of the station, necessitating four separate movements of signals and points per train. The running of excursion trains during Christmas week is, it may be noted, a new departure on the part of the railway companies, introduced to foster the growing habit of travel at this season of the year. Not only do vast numbers of people "go home" for Christmas, but an increasing number of families spend Christmas away from home, the opportunity of several consecutive days' cessation of business tempting hard-workers to seek recreation in change of scene and air. Of course, to many of those engaged in business, and particularly to shop assistants, the weeks immediately preceding Christmas are specially trying, involving long hours of unremitting toil; and this class is not overlooked in the railway companies' arrangements. The Great Eastern Company, for example, runs special midnight trains on Christmas Eve to the principal stations on its system. Leaving Liverpool Street after twelve has struck, these trains speed through the Eastern Counties during the small hours of Christmas morning, carrying to their country homes, or to the seaside, hundreds of fagged-out workers whose weeks of weary toil are soon forgotten "in that happy state of companionship and mutual goodwill" of which Dickens writes so touchingly in the chapter already quoted. A greater boon than any number of "Muggleton coaches" could be are these midnight trains of our modern Christmas; and those to whom they mean the difference between a cheerless day in London lodgings and the merriment of the family fireside should not fail to give a sympathetic thought to the engine-drivers, firemen, guards, and signalmen upon whose labours the safety of their homeward journey depends. Were the part our railways play at Christmas-time properly understood, there would be a collection for the Railway Benevolent Institution at every Christmas dinner-table.

Next to reunion with friends from whom we have been long parted, there is no sight more welcome at this festive season than the arrival of the Christmas hamper. For this joy, also, we are indebted to the agency of the railways, to the workers upon which Christmas presents, like Christmas journeys, mean a heavy strain of extra labour. Whether the parcels be sent through the post or handed in at the nearest station, the railway servants have to do the bulk of the work connected with their transport. A small proportion of the Post parcels are road-borne, but the majority are handed over by the Post Office to the railway companies for conveyance, the postal authorities confining their energies to the work of collection and delivery at either end. Even the loading into and out of the mail-carts at the stations has to be done by the companies' porters. The numbers of parcel-post hampers dealt with by the London and North-Western at its London terminus, during the seven days prior to Christmas Day, 1903, was 35,000. To facilitate the work a special large shed, eighty yards long and forty feet wide, was erected adjoining the railway at Maiden Lane, near Euston, and used exclusively for loading the parcels mails into trains.

The parcels department on most British railways is a branch of the department of the superintendent of the line. It has a quite separate organisation from the goods department, and is, indeed, a section of the passenger working. Originally, all parcels were carried in the brake-vans of trains conveying passengers, a higher scale of rates being charged than for goods train traffic, in consideration of the greater speed and regularity of the service rendered. A great deal of the parcels traffic is still carried on in this way, but in a good many cases the business developed between certain points has become so large as to necessitate the daily running of special trains devoted to the carriage of "parcels" only. All the northern lines, for instance, run special milk trains to London and other great towns, by which millions of churns are carried annually, the total for the Great Western alone being 1,113,769 cans in 1903. Special fish and fruit trains are also run by the parcels departments; but in cases where speed is not so urgent a consideration, perishable traffic is consigned by goods trains at a lower scale of charges. More than one-eighth of the total revenue attributable to the running of passenger trains on our railways is derived from the carriage of parcels, mails, excess luggage, carriages, horses, dogs, etc.; and two companies—the London and North-Western and Great Western—each earn over a million pounds a year annually from the sources just named.

This amount of preliminary explanation is necessary to enable the reader to understand the significance of the phrase "parcels department" in connection with the working of our railways. At Christmas-time the goods department has much work of an exceptional character to do—as we shall see later on—but the extra work involved upon that section of the staff is more than balanced by the comparative lightness of the general merchandise and mineral traffic consequent upon the approach of a holiday period. It is upon the parcels department that the full brunt of the pressure falls; for the things which everyone sends to everyone else at Christmas-time are just those things with which this department has to deal; whilst there is no slackening, but rather an increase, in those kinds of traffic which form the staple of "parcels" all the year round. The demand for milk and fish and fruit is greater than ever during the festive season. To give one instance, the South-Western Railway Company has to run four extra trains for the conveyance of milk-churns in and out of London on each of the three or four days immediately preceding Christmas. In addition to providing extra facilities for milk, every one of the large railway companies has to run special trains for the conveyance of miscellaneous parcels—a thing which is not done except by two or three companies at other times of the year. In the case of the London and North-Western, six special trains carrying nothing but parcels and parcel-post hampers, are run daily from and to Euston during the days of Christmas pressure, in addition to other "specials" for the conveyance of fish and perishable traffic generally, and besides the many additional parcels vans which are attached to the passenger trains. The number of parcels dealt with at Euston station during the period immediately preceding Christmas, 1903, was more than double that of any normal period of the year, besides which there was an exceptionally heavy traffic in newspapers.

I have before me as I write full particulars of the "special express parcels trains" run by the Midland Railway Company during Christmas week, 1903. The pressure began on December 21st, when three additional trains devoted exclusively to parcels were run from London and Derby to Manchester and Bradford, one from Bristol to Derby, and one from Leicester to Birmingham and back. This was on the Monday, Christmas Day being on the Friday; and the same trains, with an extra one between Leicester and Birmingham, were repeated on the following days. The number of parcels handled at

St. Pancras station alone during the week preceding Christmas was close upon 100,000. I learn from the Great Eastern Company that during the same week nearly 160,000 parcels passed through the offices at Liverpool Street, whilst the London and South-Western authorities inform me that between 125,000 and 126,000 were conveyed in the three special trains which were run in each direction over that system, to and from Waterloo, for several days before the great winter festival. The Great Northern dealt with over 22,000 at King's Cross on a single day; whilst the Lancashire and Yorkshire had about 80,000 in excess of the normal number on its system. The number of parcels dealt with at Paddington last Christmas was about 112,000, not including "transfers"—*i.e.*, parcels going to or coming from other lines. All these figures are, of course, exclusive of the Post parcels carried by the railway companies.

The special working notice-book issued by the Great Western Railway Company to its train staff for Christmas, 1903, a copy of which also lies before me, is eloquent of the amount of extra traffic which has to be provided for. We first read of a "Marlborough College Special" to Marlborough and back, Friday, December 18th, and of a similar train from Cheltenham and London on the same day with "Cheltenham Lady Collegians." On the next day the duplication of the more important main-line trains commenced, and the following half-dozen pages deal with such duplications from the Saturday till the Tuesday. On that day, the 22nd, we find a

"Special Parcel Post Train, London to Penzance," and another "Penzance to London," and three more school "specials" to London for the conveyance of the boys of Clifton College, Malvern College, and Cheltenham College respectively. These trains start early in the morning, and one can picture the happy scene as they unload their merry freight at Paddington in quick succession. Pages more of "duplicate" passenger trains follow, interspersed with "specials" for the Post Office, some for letters and others for parcels. "It is of the utmost importance," the instructions state, "that all mail trains should work as punctually as possible, and every effort must be made to accomplish this." Then comes a list of "empty stock trains" to Paddington on December 21st, 22nd and 23rd, showing that the exodus from London has exceeded the flow of traffic thither, and that it is necessary to run empty trains to redress the balance.

On pages 41 to 46 of this Great Western "Christmas Number," we read of the "Special Parcels Trains." They are "to carry 'C' head-lights," which means the same head-lights as passenger trains, so as to give them precedence over "goods" at the hands of signalmen. Of the South Wales parcels trains, which run from New Milford to London, we read: "Poultry vans to be supplied for these trains as far as possible." This is to accommodate the Irish poultry traffic, as many as 100 tons being sometimes brought over in one of the Great Western's boats from Waterford to New Milford. "The object of the special parcels trains," we read in another place, " is to relieve the passenger trains, and on the down journey to take those parcels which are too late for the last ordinary trains; it is, therefore, particularly required that the passenger trains on the before-named days may not be delayed for parcels or in any way overloaded with them. . . The parcels trains should, as far as possible, be formed of covered goods vans, horse-boxes, carriage-trucks and milk-trucks should be used for parcels and poultry, so that the passenger brake-vans can be available for passenger train working." It is no easy task to find sufficient rolling-stock for the extra passenger and parcels trains run at Christmas, and sometimes very old, and almost obsolete, coaches have to be pressed into service for these few days. Altogether, there are no less than ninety pages in the Great Western's special Christmas "Notice" for 1903, all referring to additions and alterations to the train service during the eight days from December 18th to 25th of that year.

The road cartage of Christmas parcels is a scarcely less onerous task for the railway companies than their conveyance over the lines. All except the Post parcels have to be delivered to the homes of the recipients in the companies' carts, and a great number have to be brought to the stations in the same way, especially those handed in at the town receiving-offices, many of which—particularly around London—are several miles from the railway depôts.

London, with its immense area, of course, presents the greatest difficulties. Were all the railways under one control, undoubtedly a good deal of the longer-distance cartage might be saved by utilising more fully the various suburban lines. As things are, the exigencies of competition require that every company should be, as far as possible, ubiquitous through the Metropolitan area. Where a company has no station, it must have a receiving-office, the connecting link being a frequent service of carts. Some of the large railways employ from 1,000 to 2,000 horses in London alone, and yet at Christmas time it is necessary for most of them to hire extra teams in order to overtake the work. Except for the special market traffic, to which I shall refer later, the cartage work of the goods department becomes comparatively light as Christmas draws near. Their time of pressure comes earlier, when the shops are stocking up for the winter trade. It is usual, therefore, for the "goods" to lend teams to the "parcels" during Christmas week, as many as fifty being the number thus borrowed in London on several of the leading lines. When outside hiring has to be resorted to, it is generally considered better policy for the contractors' teams to be employed on "goods" than on "parcels" work—at any rate, so far as the deliveries are concerned. The prompt delivery of a load of parcels is a task demanding a considerable amount of knowledge and experience. A man who knows his round, and is expert in the packing and sorting of the parcels, will get through in a few hours a job which would take a day in the hands of a novice. It is better to hire teams for straightforward goods cartage, which can be paid for on tonnage, and to employ none but trained railway carmen on the far more difficult passenger train traffic deliveries, otherwise the cartage may easily cost more per parcel than the whole of the sum charged on the traffic. As showing the care exercised, I may add that in the case of the Great Northern Railway, an elaborate time-table is drawn up, specially for Christmas, of all the work to be done by the forty pair-horse teams which are employed in London in collecting parcels from the town offices; whilst the work of the delivery teams is most carefully sectionalised into districts to avoid overlapping.

I have before me a pamphlet of six closely printed pages, kindly lent to me by the London and North-Western Railway Company, setting out its "Arrangements for Christmas Parcels in London, 1903." From the information therein given, it appears that about 150 collecting and delivery vans have to be found for the conveyance of parcels to and from Euston Station alone, some of these being "goods" vans borrowed for the occasion, and others being specially supplied from the company's carriage works at Wolverton, where vehicles of this class, as well as passenger carriages, are built and repaired. The provision of sets of harness, tarpaulins, ropes, lamps, and other gear for these extra vans is also a matter which has to be specially arranged for. The extra carmen required are provided by the goods department, and choice is made of the most experienced men for the delivery work, their places on the "goods" staff being temporarily filled up by others of the staff who are able to drive. Special instructions are given that full loads shall be made up, so as to avoid two carts running over the same ground at short intervals. It also appears from the pamphlet that clerks and porters are lent by the "goods" to the "parcels" for the Christmas work, and every precaution is taken that the staff provided shall be adequate for the task they have to perform, so that all delays shall be avoided. As at other times, so at Christmas, "Keep everything moving!" is the motto of the staff. If the work were once allowed to accumulate, it would be fatal to the whole organisation. Everything must be cleared up as soon as it is received; otherwise the machine would become hopelessly clogged. It is pleasant to learn that the physical needs of the men employed for such long hours at the railway parcels offices at Christmas-time are not forgotten, special arrangements being made for the provision of refreshments to the staff.

What happiness these Christmas parcels bring! And what disappointment and grief are connected with those which go astray! In the euphemistic language of the railway offices, these derelicts are known as "salvaged" parcels, which means that, all efforts to trace their destinations having failed, they have been sold for what they would fetch. As many of the Christmas parcels consist of perishable goods, discretion has to be allowed to the officials in charge of the various parcels offices to make the sales as promptly as may be necessary. It would be no good holding over a turkey or a brace of pheasants until the company's periodical salvage auction came round. At the offices of one of the leading railways I was allowed to glance through the list for the previous year. There were but fifty "salvaged" in London out of a total of over 100,000 handled, and in most cases the senders were at fault for not taking sufficient care in addressing the packages. People send away parcels by rail at Christmas who probably never do so at any other time of the year, and some of them apparently think that the companies employ a staff of thought-readers, and can dispense with plainly written instructions. If the public would but observe the simple rule of placing a duplicate address-label inside all hampers, parcels, etc., in fewer cases would Christmas festivity be marred by the tragedy of the non-arrival of the promised turkey or goose.

"Barrel of oysters," "Brace of pheasants," "Hare," "Turkey in feathers," "Goose," "Basket containing presents," "Four rabbits," "Goose dressed," "Leg and loin mutton, "Box containing cake, puddings, and photo," "Bag of evergreens and holly," "Small Christmas pudding," "Box containing pork pies, sausages, and pork"—these are some of the items which I copied from the "salvaged" parcels list above referred to. Incongruously mingled with these signs of "misdirected" benevolence were: "Tin tray from parrot's cage," "Parcel of trouser-linings," and "Two motor-tyres." It was rather grievous to read that the Christmas pudding was "sold for sixpence," and that the holly and evergreens were "thrown away"; but one need not expend sympathy upon the intended recipient of "four pieces of beef," which were "condemned by inspector as unfit for food." The "box containing cake, puddings, and photo" was still "on hand" when the list was drawn up.

I have said that the traffic carried by the goods trains on our railways is comparatively light during Christmas week, owing to the approach of a period of general cessation of business. There is, however, one important exception—the traffic for the Christmas cattle-shows and dead-meat markets. Despite the competition of American and Colonial meat, "prime Scotch" is more than ever in demand every year for the Christmas sales, and the lines running into London and other great towns from the North have a day or two just before the great carnival when the "meat" trains from across the Border are of even greater concern to the officials than the "Flying Scotchman" itself. In 1903 the pressure was specially great, because Christmas Day fell on a Friday. This necessitated all the meat getting to market at the beginning of the week; and the Scotch packers, true to their traditions, would not hear of despatching their consignments on the Sunday. Ordinarily the pressure is spread over two consecutive days; but, as no one would risk waiting until Monday before despatching, practically the whole special traffic was handed to the railway companies on the Saturday, and arrived in London between nine and ten on the Sunday night. The authorities there knew well they were in for a big night, and they had made their preparations accordingly. The strain upon the cartage department may be gauged from the fact that the North-Western Company sent out about 350 van-loads of meat from their Broad Street and Camden goods stations to Smithfield during that one night, effecting delivery in every case in time for the market on the following morning. This was four times the work of an ordinary night, so far as the meat traffic was concerned. The total tonnage of meat dealt with at these two London stations on the Sunday was no less than 877 tons, and the total for the week ending December 23rd, 1903, was 2,214 tons. More than one-third of the total dealt with during this exceptionally busy week had, therefore, to be carted within a single night.

The cattle-show traffic comes a week or two earlier than the dead-meat. For the Islington show no less than 700 head were brought up by rail from the North in 1903, which is, of course, only a portion of the special live-stock traffic carried at this time between Scotland and the South. On the 11th of December 1903, the Caledonian Company ran four special livestock trains for the Christmas markets, containing a total of seventy-seven cattle-trucks, heavily laden. The total number of animals passing through Aberdeen by rail during the days when this traffic is at its height averages about 4,000 head, made up of about 2,000 cattle, 1,500 sheep, and 500 pigs. Some of the prize cattle make a round of the provincial shows before coming to Islington. For example, no less than sixty-two animals taken into Birmingham for the Bingley Hall Show were afterwards brought on by the North-Western to London for the great show at the Agricultural Hall.

A prize beast, when travelling by rail, is a personage of distinction. He has his "reserved compartment" on the cattle-train, specially fitted up for his comfort and protection; and when he is doing a round of the shows, the same truck is usually kept for his use throughout his travels, in much the same way as special saloons are provided for eminent human travellers. On arrival in town the beast will walk to the show, if the distance be not too great to impair his "condition." Otherwise he must be "floated"—*i.e.*, conveyed by the railway company in a special form of cart technically known as a "float." At Sheffield there is a big pleasure-fair held during Christmas week, for which a great many passengers and show vans are carried by the Great Central and other railways serving that town. Special trains are run on Christmas Eve for the Christmas markets by the Lancashire and Yorkshire and other northern lines.

In connection with Christmas pantomimes a large amount of special traffic comes upon our railways. In 1903 the Great Northern Company alone carried about 500 artistes from London, to appear in theatrical entertainments on Boxing Day in various provincial towns, and so great is the traffic in theatrical scenery and properties on this line, before the opening of the pantomime season, that a covered "dock" has to be set aside at King's Cross specially for loading up theatrical freight. For the conveyance of the big "sets," special open trucks, forty-five feet long, are provided.

The great enemy of the railway companies at Christmas-time is fog. Snow is a special difficulty on the lines in the extreme North, and frost entails some anxiety to the horse and cartage departments; but the fog fiend is a universal foe. The worst railway Christmas on record was that of 1891. About 10 a.m. on Sunday, 20th December of that year, a dense fog descended over the Metropolis and lasted practically without intermission until 8 p.m. on Christmas Day. It was at times so intense that a fog-signalman standing at the foot of a signal-post fifteen or twenty feet high could not see the light in the signal-lamp, and men standing only a few yards apart could not see each other. A shunter standing by a pair of rails could not tell whether it was the main line or a siding, or what siding, and he could only ascertain his exact position by following the rails and seeing where they led him. Sir George Findlay, the late general manager of the London and North-Western Railway, drew up a special report in connection with this memorable fog, from which I have been permitted to take the following details.

On Monday, 21st December, the trains from Euston got away fairly in time, but as the fog continued and the work of sorting and marshalling the carriages got behind, the departures became more and more unpunctual. The climax was reached when, on the Wednesday night, a train which should have left at 10 o'clock, did not get away until 12.40 midnight, two hours and forty minutes late! This is believed to be the worst start a train has ever made from Euston. Great difficulties were also caused by the lateness of the Post Office vans in reaching Euston with the outward-bound mails, owing to the fog in the streets. On the Thursday night all the North mails missed the earlier trains and had to be crowded into the 10 o'clock, which thus occupied two hours in loading.

The fog extended down the line from London to Rugby, and was general in Yorkshire and some parts of Lancashire. All the up trains into London were, therefore, running badly and arriving as much as two or three hours behind time. The result was that in many cases men timed to work certain trains into Euston, and certain other trains out, arrived with the incoming train after the outgoing ones had departed, other men having in the meantime had to be found to take their places on the latter.

As can be readily understood, the fog-signalling became a very serious problem. Owing to the long continuance of the fog, the supply of properly trained men became exhausted, and in many cases unduly long hours had to be worked. In only four cases, however, was it necessary to require men to work more than twelve hours continuously, and one of these was due to an accident, the relief man falling and hurting himself on his way to his post. The difficulties under which trains were sorted, marshalled, and made up in the sidings at Euston can be more easily imagined than described, and every man engaged in that service incurred considerable risk every time he went on duty. It was, as Sir George Findlay said, extremely creditable to the discipline and devotion of the staff that the work was carried on at all under such circumstances and did not come absolutely to a stand. It was a surprising fact, and one worth recording, that during the four days, when the shunting and marshalling of the trains was carried on at Euston under the great difficulties above described, there was not the slightest accident to life or limb of any man employed, nor was there any damage to rolling-stock, not even to the extent of a broken buffer-casting.

The severe frost which prevailed all the week helped to delay the trains and embarrass the working. The rails were slippery, and the proper speed could not be maintained even when the line was clear. Moreover, it was necessary to make more than the usual stops with the passenger trains, in order to examine the wheels, etc., and to take water. The troughs for taking water by engines in motion could not be used for fear that the water splashing up would freeze the brake-gear under the carriages. At Crewe, which is the key to the North-Western system, the difficulties were focused. Out of 313 down passenger trains arriving at Crewe during the four days, 80 were half an hour to an hour late, 83 were from one to two hours late, and 15 were over two hours behind time. Out of 324 up passenger trains, 94 were from half an hour to an hour late, 38 were between one and two hours late, and 11 were over two hours in arrear. The rest ran somewhat better, but there was none that was not more or less late. To those who know the normal standard of punctuality attained on the North-Western, these figures are eloquent of complete disorganisation. As to the goods trains, nearly every one was several hours behind time in reaching its destination, and some of them never reached their destination at all. Owing to the impossibility of supplying relays of men to work them, they had to be broken up, and the wagons worked forward in other trains after the pressure was over. In other cases complete trains had to be shunted into sidings, there to remain until after Christmas Day. On 23rd and 24th December there were many cases in which the engine-drivers and brakesmen undoubtedly required relief, but, as it could not be provided, they had to continue at work. They did so cheerfully, recognising the difficulty of the situation, and "there was not a single case," the general manager reported, "in which a man complained of hardship, or any mishap occurred."

There have been foggy Christmases since, notably that of 1904, which was nearly as bad as 1891. Everyone will join in the wish that it may be long before we have another like those. Under the most favourable conditions, the extra strain imposed upon our railway servants by Christmas travel and traffic is unquestionably great. Under a long spell of fog, it is well-nigh intolerable.

To avoid possible misapprehension, I should, perhaps, say that the railway companies not specifically mentioned in this chapter, as elsewhere in the volume, are omitted simply because it is not possible to mention every one of them individually. The facts and figures given are intended to be typical of our railway system as a whole. The special pressure of Christmas traffic is general throughout the Kingdom, and the experiences of each line are shared, with slight variations, by all the others

I have already alluded to the Railway Benevolent Society, but should like, before I close this volume, to say a few further words in favour of that excellent institution, the object of which is to provide help in time of need for disabled railwaymen, and for the widows and orphans of those who fall in the service. Since the establishment of the institution in 1858, upwards of £600,000 has been distributed amongst the widows of some 4,600 men killed, 10,700 who died of sickness, and 97,000 who were injured in the performance of their duties; 2,417 widows and disabled servants have received pensions; and 1,549 children of both sexes have been educated and sent into the world fit and useful members of society. At the present time 1,528 members and widows are receiving annuities of from £10 to £30 each, and 336 children are being reared, trained, and educated in the orphanage at Derby and at other schools. The institution has no sectarian bias, and it is open to all classes of men on all lines of railway in Great Britain and Ireland. It is officially recognised and assisted by the railway companies, controlled and managed by their chief officers, and every proper case is carefully investigated and promptly relieved as far as the funds will allow. The offices are at 133, Seymour Street, Euston Square, London, N.W.

THE END.

WARD, LOCK & CO., LTD., LONDON, NEW YORK, & MELBOURNE.