

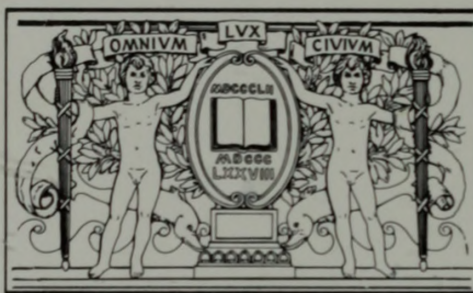
RAILWAYS

C. HAMILTON ELLIS

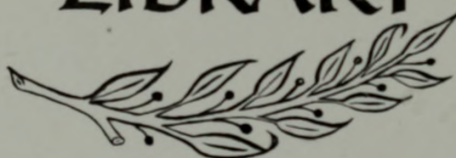
A Pictorial History
of the first 150 years

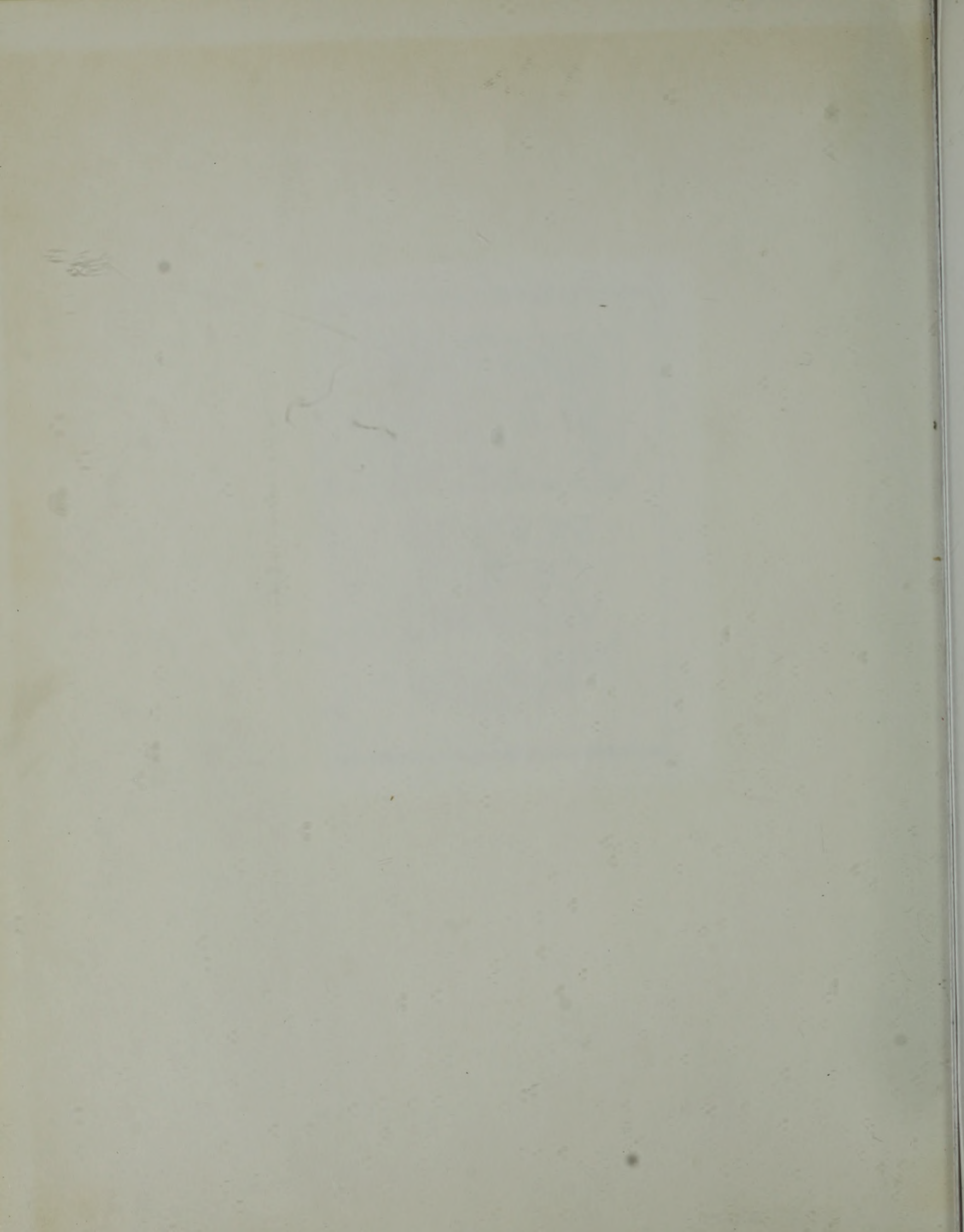
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RAILWAYS

A Pictorial History
of the First 150 Years

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You are about to enjoy the most comprehensive visual record of the history of railways ever assembled in one single volume. Edited by an acknowledged authority, it takes you from the very beginnings up to the late 1950's when presumably we all became aware of the subject from personal observation and experience. Here are those rich, formative years before our own age of awareness, displayed pictorially (over 400 photos) and accompanied by a knowledgeable and pertinent commentary so that we might enjoy its reading over and over again. The British editor may have tended to emphasise the European contribution, but since his expertise in the field is unassailable and since the wealth of detail he has provided is as impressive as in any other published document within our memory, we hope you agree that a small bias is more than compensated for by such a massive compendium of information and entertainment.

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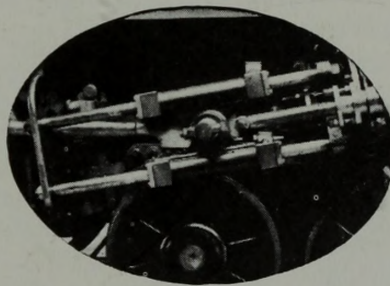
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by
C. HAMILTON ELLIS



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Foreword to this Edition

There are no rival claims as to who actually invented the steam railroad, which was the world's first form of guided transportation under any sort of mechanical power. The thing did not exactly happen in America, in spite of people like Oliver Evans. It did not entirely happen in England, for it was, both really and rarely, a Celtic invention. Richard Trevithick, designer and maker of the first practical locomotives – indeed the first ever to go on rails – was a Cornishman.

Northwards across the water from Cornwall is Wales; southwards lies Brittany, where, indeed, a distinguished family name is that of Trevidic. To early Anglo-Saxons invading from North Germany and Denmark, all these people were *Welsh*; that is, foreigners or, more properly if insultingly, *natives*. The race survived. Even the Saxons married the British widows and so produced the English.

Centuries rolled by. In 1802 the Cornish mining engineer, Dick Trevithick, produced a road traction engine that worked. Two years later he showed that his locomotive could haul an astounding-heavy train of wagons on a Welsh mining tramroad.

Yes, Trevithick was a Celt! But his first railway locomotive was built at Bridgnorth, up the River Severn on England's Welsh Marches. So England and Wales – not even Scotland – became the cradle of the steam railroad.

Public railroading for both freight and passengers really began in 1830, with steam for both. In England it happened between Liverpool and Manchester, on September 15. In America it happened on Christmas morning, westerly out of Charleston, South Carolina. Surely honours are fairly even, after many years, on that point!

There were these differences: Europe, through England, had the rail imposed on it, sometimes against much resentment. In America, that same rail and its engines turned old colonial-style States into a great Federal Republic, stretching from ocean to ocean. Some years later, the same sort of thing happened in Canada. In South America, railroads turned the old Latin colonies into viable republics at last; quarrelsome if you like, but just such! In England, the landed gentry regarded the rail as an invader of privileges and a spoiler of property. Scotland, birthplace of James Watt and also of steam navigation, was more welcoming. The German States saw in it grand strategy; also a means of coping with incipient revolutions. The infamous King of the Two Sicilies on the other hand saw it as an agent of revolution, and kept it closely fettered while he lasted on his menaced throne. America, unlike all these, received it with a shout of joy. Where the railroad went, the Great Republic followed.

Therein lies a great difference, from the first, between Old and New World railroad traditions, beginning with the visible difference between the *Rocket* (of Liverpool) and the *Best Friend of Charleston* in 1830. Existing to-day are not only differences of operation, but also in between the conception of a sink-or-swim company operation in the States, with very little passenger traffic, and that of subsidized and State-owned European lines, continuing to carry many passengers as well as freight. In spite of the rash of car-ferrying, you can still take a sleeper from London to Paris or Brussels, or from Oslo and Stockholm to both West and East German cities. For that matter, you can take one, for days and days, from Moscow to the uneasy borders of China, with no ferrying needed.

One need not be a railroad buff to be thrilled by the idea of travelling on the mystical Orient Express. This book is, then, for romantics as well as for experienced scholars of railway history.

Railway Saga

THROUGH the long history of mankind there have been rare and momentous discoveries, giving rise to inventions that have changed the way of history and the ways of living. In remote pre-history, man discovered how to make a fire; how to catch, break-in, and ride a horse. He invented the wheel and the boat. Those were the two basic inventions of transport before thoughts turned to wings, outside the compass of superstitious wishful thought. Only within the past two hundred years came mechanical transport. Its first great practical form by land was the steam railway, and the coming of this will ever remain the most potent event in land transport history. More than anything else, it changed both the face and the nature of the man-made world.

Steam has vanished from the locomotive in much of the world now, being confined within great central power stations. Dutch steam locomotives succumbed early. We have seen, in rather more than half a century, the impact on transport of the motor engine, which has brought fast conveyance to the roads and made the air navigable. But it was the steam locomotive, running on a smooth, confined track, that was the revolutionary agent. Electric traction, the motor, and the aircraft even, have been evolutionary.

Until the railway came, every large city had to be on a navigable waterway if it were to expand beyond certain strict limits. The deep country was indeed deep. When Cobbett rode his rides, the English shires had changed little, in essentials, since the Reformation. Save to the adventurous and the hardy, the mountains were inaccessible; or at least their passage, even by a well-defined road, was essayed only under dire necessity. North America was an enormous wilderness, with fringes of colonial civilization along the seaboard and up the greater rivers. So was South America. Siberia was not so much a dumping-ground as an almost infinite oubliette for convicts. So was Australia, a continent otherwise empty save for archaic animals, and for a primitive race which had paradoxically invented a sort of aeroplane in the form of the boomerang.

Now we may fly about our planet, reckoning our journey times in hours. But the steam train has been the torchbearer by land, as was the great ship by sea.

The railway, as we know it, was not a spontaneous invention. Necessary to it were the gradual perfection of the rail itself, and the evolution of motive power

in the form of the high-pressure steam engine. Those two had to be imposed on the existing art of road-building. Coupled with that, it needed a social state in which a new means of fast transport was necessary. That was provided by the industrial revolution, itself the result of the low-pressure steam engines of Newcomen and Watt in the eighteenth century. Lastly there was needed a great reserve of labour to carry out the new works. That was provided by the pool of muscular unemployed left by the close of the Napoleonic wars, and the completed construction of the turnpike roads and canals. Given all these things, the railway happened.

But in going back to the beginning of things, it is scarcely possible to give even an approximate date to the first appearance of wheels on rails. The ancient world knew the rutway. In old Pompeii, ruts of standard width, little different from that of the majority of the world's railways now, kept vehicles confined on narrow streets so that they did not strike adjoining buildings. The Romans had a *standard gauge*. There is something more definite in the records of mining in Transylvania during the sixteenth century. There, *flanged* wheels on wooden rails served to guide the miners' tubs underground. In England, wagon-ways were in use about the North Country at the close of the first Elizabeth's reign, and thereafter, such primitive lines gradually increased. They took several forms. Either the wheel or, more often at first, the rail, would be flanged. The flanged rail took the form of a series of iron or stone plates, the former mounted on blocks, by which the wagons and carts were guided. To these we owe the archaic term *platelayer* for a permanent way maintenance man.

From the eighteenth century we recall a few quaint 'firsts'. Sir John Cope appears to have been the first general to make strategic use of a railway. At the battle of Prestonpans in 1745 he drew up his men along the line of the Tranent and Cockenzie Wagon-way, whence, shortly after, they were driven by wild and yelling Highlandmen—the first force to capture a railway, though doubtless they did not bother much about that. Previously, in the early seventeen hundreds, someone built for Louis XV the first passenger railway, a pleasure line in the gardens of Marly-le-Roi, notably distinguished by the possession of a turntable. Horses provided motive power on mineral railways, but the French line had manpower.

Most of what we might call the archaic railways were simply part of the industrial equipment of contemporary firms, particularly in connection with collieries. A railway would connect the pit-head with staithes on the riverside, whence coal was carried coastwise. Historical milestones were passed in the succession of the first public goods railway, the first public passenger railway, the first steam colliery railway, the first steam public railway, and the first railway to use steam traction with locomotives for all traffic. Those events were spread over the first thirty years of the nineteenth century.

In view of the pioneering work in the North Country, it is remarkable that the first public railway in the world belonged to the South of England, while the first to carry passengers was in South Wales, as was the first demonstration of a steam locomotive. In 1799 it was proposed to build a horse tramroad, open to the public on payment of tolls, between London and Portsmouth. Part of the scheme was indeed carried out, in the shape of the Surrey Iron Railway, and its extension the Croydon, Merstham and Godstone Railway. The former, built from Wandsworth to Croydon under an Act of 1801, was opened on

July 26, 1803, and to it were added, in the following summer, a branch to Hackbridge and a basin with lock gates at Wandsworth on the Thames. The track was double, and the trains were, of course, horse-drawn. The whole point of railways, as opposed to roads, was that on the former the motive power, in the horse's tractive effort at hoof, could shift a very much heavier load than on an ordinary road surface. At the opening of the adjacent Croydon, Merstham and Godstone Railway to Merstham in 1805, one horse hauled a load of 55 tons 6½ cwt. in sixteen wagons.

William Jessop was the engineer of these lines, which he built with flanged iron plates on stone blocks. The C.M. and G.R. never reached Godstone, but relics of both railways survive, including stone blocks built into walls, and a complete length of track preserved at Merstham. The Merstham line crossed the Epsom-Coulsdon road on what was probably the first railway bridge. Meanwhile, in June, 1804, there was incorporated the first company to work a passenger railway—the Oystermouth—or as it was afterwards called, the Swansea and Mumbles Railway. Opened in 1807, its carriages were horse-drawn and its original permanent way consisted of iron plate rails. Horse traction was perpetuated into mid-Victorian times. The line itself lasted a century longer, latterly using what were undoubtedly the largest electric tram-cars in the world. From the 'seventies to the end of the nineteen-twenties it was a steam line, with locomotives hauling double-deck trams.

The First Locomotive

Steam railways, with locomotive haulage, were made possible by Richard Trevithick's high-pressure engine. After experiments with a road engine and a steam carriage, he built a locomotive which in February, 1804 was the first in history to run on rails. It was a single-cylinder engine with a flywheel and transmission through spur wheels. It was tried out, and successfully hauled its load, on the Penydarran tramroad in South Wales. In the following year a Trevithick locomotive was built for the wooden wagonway at Wylam on Tyneside. It seems never to have worked—the track was against it—but it deserves recall in that it was the first locomotive to have had flanged wheels. In the summer of 1808 Trevithick ran a locomotive called *Catch-me-who-can*, with a passenger carriage coupled. The public was admitted for a small fee, and the adventurous could have a ride. They may be described as having been the first fare-paying passengers to travel on a steam railway.

It was believed that, to be a commercial possibility, a locomotive must exert more grip on the rail than was possible with a smooth wheel. John Blenkinsop devised, in 1811, the rack-and-pinion principle, used years after for steep-grade mountain railways. In the following year it was used with locomotives designed by Matthew Murray, on the Middleton Colliery Railway near Leeds. The original engines were in service there until 1835.

In 1813, William Hedley patented a geared transmission with drive through smooth wheels, and a locomotive equipped with it was built by Jonathan Foster, enginewright at Wylam Colliery, and Timothy Hackworth, the smith. This was the memorable *Puffing Billy*. It broke the iron plate rails, and to remedy this it was rebuilt as an eight-wheeler with a primitive form of bogie. When the Wylam Colliery line was relaid with edge rails, about 15 years later, *Puffing Billy* and a sister engine, *Wylam Dilly*, were each mounted on four flanged

wheels. In this form they both survive, at South Kensington and Edinburgh respectively.

Now was the childhood of the locomotive, following its infancy. Various men applied themselves to it, but chiefest were George Stephenson, the enginewright at Killingworth Colliery, and Hackworth, the smith at Wylam. Hackworth was perhaps the greater mechanic; Stephenson had courage, perseverance, and imagination in business. He built his first locomotive, *Blucher*, in 1814, nearly eleven months before the Battle of Waterloo. Geared transmission went out. Stephenson used direct drive and coupled the wheels, at first with endless chains.

Ten years later, England saw the opening of the first public railway to use steam locomotives in regular traffic, the Stockton and Darlington. At first, passengers were conveyed in horse-drawn coaches, in between the steam coal trains. The line was an enterprise of the great Quaker family of the Peases, and had been authorised in 1821. Its first locomotive, built by Stephenson late in 1824, was the *Locomotion*, which is still preserved at Darlington Bank Top Station. Ceremonial opening of the Stockton and Darlington Railway took place on September 27, 1825.

On May 3, 1830, the Canterbury and Whitstable Railway was opened. It was indeed the first all-steam line, but traction was chiefly by cable.

There was already great need for inter-city railways, carrying all traffic by steam. The first railway, in the sense of our present understanding of the term, was the Liverpool and Manchester, built during the late eighteen-twenties with George Stephenson as engineer. It was not until 1829 that locomotive- as opposed to cable-haulage, was decided upon, and a prize competition instituted (the Rainhill trials). Of the two really practical entries, Hackworth's *Sans Pareil* had bad luck. The prize-winner was the *Rocket*, of George and Robert Stephenson. It had inclined cylinders and a multitubular boiler, the latter an inspiration of Marc Seguin of France. A civil engineering triumph of the L. and M.R. was the building of the line across the quaking bog of Chat Moss. It confirmed Stephenson's reputation as a constructor as well as a mechanic.

Ceremonial opening took place on September 15, 1830, with the Duke of Wellington, as guest of honour, performing the ceremony. It was an unfortunate occasion. One of the distinguished guests, and a great supporter of the railway (unlike Wellington) was William Huskisson. He was a most worthy and able political figure, but physically a clumsy man with a curious tendency to fall over things. Now he fell down in front of the *Rocket* at Park-side, and died at Eccles the same night.

In spite of the awful omen, the steam railway had arrived. Though violently opposed in Parliament and in the country by some of the landowners (by no means all), more and more lines were built. Railways boomed on 'change. By 1840 there were three great main lines out of London. First came the London and Birmingham, built by Robert Stephenson. It was just preceded by the Grand Junction, linking Birmingham with the Liverpool and Manchester at Newton Junction, so the three railways between them provided through railway transport between the capital and the rich North West. There was the Great Western to Bristol, with the Bristol and Exeter continuing westwards; there was the London and South Western to Southampton. In the Great Western and the South Western was seen the shape of competition to come. The two

companies were attacking one another before they had opened their first lines, and to those who saw far it was clear that there would be a battle for the West of England sooner or later.

Already, in the North, there was the Newcastle and Carlisle Railway, the first line to be built from coast to coast. In 1842, the Edinburgh and Glasgow Railway was opened as the first inter-city line in Scotland. In Ireland there was a line between Dublin and the packet station at Kingstown. Lines were spreading abroad, too. The first section of the Linz-Budweis Railway, in the Austro-Hungarian Empire, had been opened in 1827, and the St. Etienne-Andrezieux Railway in France in 1828. Both used horses for motive power. The first German railway, Nuremberg-Fuerth, came in 1835. On Christmas Day of 1830, not long after the Liverpool and Manchester opening, the locomotive, *Best Friend of Charleston* (delicious name!), made her debut on the South Carolina Railroad in the United States. The railway was opened, as the first regular steam line in the U.S.A., on January 15, 1831.

The Giants

The great new railways made famous the names of the engineers who built them. There was the incomparable Isambard Kingdom Brunel, builder of the Great Western. There was Joseph Locke, of the Grand Junction and the London and South Western. There was Robert Stephenson of the London and Birmingham. People marvelled at the magnitude of the works—the enormous embankments and cuttings, the superb bridges, tunnels like Brunel's through the oolite near Box and Stephenson's through the Kilsby Ridge on the London and Birmingham line. These two engineers were later responsible for the first of what might be called the giant railway bridges—Stephenson's Britannia Bridge across the Menai Strait on the Chester and Holyhead Railway, opened in 1850, and Brunel's Royal Albert Bridge across the Tamar between Plymouth and Saltash, completed in 1859.

Indeed, yes, the railway had arrived. Tried and proved, it attracted the investing public with the inevitable, unfortunate result of panic speculation. The late autumn of 1845 and the early part of 1846 saw the Railway Mania, perhaps the worst thing of its kind since the South Sea Bubble. Nevertheless, the lines were built. George Hudson, great speculator and great amalgamator, enjoyed passing fame as the Railway King. He had formed the Midland Railway by amalgamation, and laid the foundations of the North Eastern, before he crashed, financially and morally done for. From that feverish era dates an enormous proportion of the British main lines of today. By 1850, London and Edinburgh had been linked, by completion of the High Level Bridge at Newcastle-on-Tyne and the Royal Border Bridge at Berwick-upon-Tweed.

Yet in those twenty momentous years since the opening of the Liverpool and Manchester Railway much opportunity was lost as well as taken. Almost a contemporary starter with the passenger train was the steam carriage, the forerunner of the motor-car. Most ironically it was stifled by those very highway authorities for which it could have done so much. The ideal land-transport system—a network of great main-line railways, linked and fed by mechanical road transport—was lost to the nation. And because other nations imitated, it was lost to the world. When the motor-car finally arrived, years after, it came not as a complement but as an adversary.

Another bad feature of the railways' first expansive phase was the very disordered planning of the various systems. There was a horror of monopoly; cut-throat competition was welcomed in many quarters, and hundreds of uneconomic lines were built without any particular benefit to industry and travel. There was much more of planned system in countries like Belgium and Russia, where the Government took a hand from the start, and in France, where railways were built under concessions.

We paid also a rather considerable price for our own virtue as pioneers. When the first main-line railways were built, it was little realised how much larger railway rolling stock might be compared with road vehicles. The British railway carriage began as an adaptation of the stage-coach. Hilaire Belloc described the early examples as resembling three stage-coach insides tacked together. Brunel was more visionary than others. He built the Great Western to the broad gauge of 7 ft. 0 $\frac{1}{4}$ in., instead of on the 4 ft. 8 $\frac{1}{2}$ in. colliery-line gauge. His motive, even so, was not so much to achieve spacious vehicles as to give steady running and plenty of room for the mechanical parts of locomotives. The broad-gauge Great Western and its allies, in time, reaped the difficult harvest of nonconformity. As railway linked up with railway, a break of gauge became an ever more intolerable nuisance. Gradually the system was mixed, and then narrowed. The last broad-gauge trains ran on the Great Western in May, 1892. For many years they had been famous as the fastest and most comfortable trains in the world. Fifty to sixty miles an hour was a commonplace on the broad-gauge in the eighteen-forties, but nowhere else.

During the 'forties, too, mechanical engineering made great strides. In Great Britain the steam locomotive took the basic form of one by the Stephenson, the *Planet*, built for the Liverpool and Manchester Railway in 1830. Edward Bury initiated the bar-framed locomotive, taken up and perpetuated in America. Daniel Gooch on the Great Western developed the classic Stephenson type of locomotive into something potent, reliable, and in its day quite enormous. Through the mid-Victorian years advance went on in the hands of such great engineers as J. E. McConnell and John Ramsbottom on the London and North Western, Archibald Sturrock on the Great Northern, Matthew Kirtley on the Midland, and Joseph Beattie, pioneer of feed-water heating and inventor of gadgets galore, on the South Western.

Vehicle design was, it must be told, rather stagnant. Until Gladstone's Act of 1844 made compulsory the running of trains in which third-class passengers were carried in fully protected carriages, at an average speed of not less than 12 miles an hour, at a fare of a penny a mile, nothing was considered too bad for the cheap traveller, who had to ride in an open wagon, attached to a goods train, and usually to begin his journey at some peculiarly ghastly hour of the night or early morning. It was not until the middle 'seventies that, at the instance of James Allport, general manager of the Midland Railway, third-class travellers on that line were carried on the best expresses, in carriages with upholstered seats. It was said against Allport that he did this simply in order to poach traffic from his neighbours, especially the London and North Western, but it is well-known that he took great satisfaction in bettering the lot of his less wealthy patrons. Certainly the Midland trains were second to none for comfort and convenience, and by degrees other companies were obliged to imitate.

Also on the Midland Railway, Pullman cars were introduced from America

in 1874. George M. Pullman had experimented with sleeping cars of an improved type as far back as 1859. He built his first entirely new car, the *Pioneer*, in 1865. Early Pullmans were of two kinds. There were the sleeping cars, in which the passengers lay down in two tiers of berths on each side of a central gangway, with one or two private compartments at the end, and the 'parlor car', as it was called in America, which had a double row of arm-chairs. Sleeping cars had, however, already made their appearance on British railways. Right back in the beginning there was the 'bed carriage', where the passenger stretched himself, by means of twin-sticks and a cushion, across the daytime footspace. In 1873, the North British Railway built the first British sleeping car, a saloon with six convertible berths arranged in two compartments, and the Great Northern and London and North Western companies followed its example in the same year. These early sleepers were for first-class passengers only. We did not get third-class sleeping cars until 1928. A luncheon was served on the Press run of the first Midland Pullman train in 1874, but it was not until 1879 that a regular dining car service appeared, on the London-Leeds service of the Great Northern. It was provided in a Pullman car called *Prince of Wales*, which contained a dining-room, a smoking-room, and a kitchen at one end. The world's first dining car, incidentally, ran on the Great Western Railway of Canada in 1867. All Pullman cars, and sleeping cars, were provided with lavatory arrangements, hitherto almost unknown on British trains, though a form of portable water-closet was used in the royal trains and in some special saloon carriages.

Signals and Telegraphs

Railway signalling was at first of the most rudimentary sort. Railway policemen signalled the trains by hand, and with lamps at night. The semaphore was, however, already in existence, being used by the Admiralty and by such concerns as Watson's, which worked a semaphore telegraph line between London Bridge and the Downs. The Watson company used the true semaphore, with arms. Admiralty signals were sent by a code indicated by the opening and closing of shutters. The semaphore was introduced to railway signalling by Hutton Gregory on the London and Croydon Railway at the beginning of the 'forties. It was standardised by the neighbouring South Eastern, and London and Brighton Railways, in 1842. Detonators for fog signalling appeared in the previous year. For some years, fixed signals took many forms. The Great Western favoured the disc and cross-bar type. The disc, presented to the train, indicated 'proceed' while the cross-bar, pivoted to it at right angles, meant 'stop!' Interlocking of signals and points made its appearance in the late 'fifties. The first complete interlocking, with signals governed by the position of points, was put in at Kentish Town in 1860.

At first, train movements were governed by 'time interval', that was, the setting of a fixed signal at 'danger' for a certain period after the passage of a train. It had its good points so long as Rules were observed, but was not fool-proof, and when trains grew faster, heavier and more frequent, there were several bad accidents under time-interval, notably at Winchburgh on the Edinburgh and Glasgow in 1862, Egham on the South Western in 1864, and Long Eaton on the Midland in 1869. In each case there had been a gross breach of rules.

But such neglect could also cause failure of the block system, under which no two trains were allowed to occupy a section together. The dividing of a railway into block sections was made possible by the invention and use of the electric telegraph, which had begun as an independent appliance, although Cooke and Wheatstone's first line was indeed beside the Great Western Railway between Slough and London. As signalling science advanced, it had to be continually borne in mind that no mechanical improvement could be allowed to encourage a corresponding slackening in the observance of rules. Block working was used on the little Norwich and Yarmouth Railway as far back as 1844, but for some years it was chiefly regarded as an additional safeguard in the working of certain long tunnels. That did not prevent a disastrous smash in Clayton Tunnel, Brighton, in 1861, due to one of the signalmen (grossly overworked) sending an ambiguous message. As much nonsense is often written nowadays about excessive hours, let it be remarked that the Clayton Tunnel signalmen in 1861 worked a 24-hour day on alternate Sundays, with every other Sunday off, so that the day and night shifts could be changed week-by-week. Enginemen often worked longer shifts than this, booking off when they brought their engines home.

Let us briefly survey the progress of that half-century between the Stockton and Darlington opening and the mid-'seventies. It began, as we have seen, with the first public steam railway. At its conclusion the British railway system extended from Penzance in West Cornwall to Wick and Thurso in Caithness. There were three main routes between the South of England and Scotland: West Coast, provided by the London and North Western and the Caledonian companies; East Coast by the Great Northern, North Eastern and North British; and Midland by the Midland Railway and, in Scotland, the Glasgow and South Western and the North British again. Now, not only the rich industrial areas, but the remote mountain places were served. The Irish main lines had been built, and Irish country lines which never could be expected to pay anything like a handsome return in money, even without motor competition, were being built. There were railways all over Europe, even in Sweden, where a cautious government, encouraged by the iron-mining industry, had begun in 1856 the building of a planned State Railway. The Americans had taught Russia how to build railways over great distances. Great Britain, America and Germany were all showing the Russians how to build locomotives.

In America itself, the expansion had been prodigious. The United States, now and since many years, land of the motor, formed an empire built on rails—and to those American friends who take a scunner at that lovely word 'empire', be it remembered that they had a famous train called *The Empire Builder*. At first American railroad expansion was between city and city, or linked old waterways. Lines were built more cheaply than with us. Huge earthworks and long tunnels were avoided wherever possible; the line would go slap through the middle of a town, along the main street, and socially there would be a right side and a wrong side of the railroad tracks. That word railroad, by the way, is good Georgian English which America kept and we unfortunately dropped.

Out into wilderness and prairie the American railroads were now pushed, and where they went new towns sprang up and grew into cities. During the 'sixties there was fought the first great war to be decided by mechanical transport. General Longstreet saved the Confederate situation at Chicamauga by rushing

up a division in all the trains he could seize, but in the end the North prevailed owing to its technical and industrial advantages. Sherman's Atlanta campaign was made possible by the United States Military Railroads organisation. After the war came the great push to the West. On May 10, 1869, the Union Pacific Railroad's engine No. 119 and the Central Pacific's *Jupiter*, from the Missouri and the Pacific Coast respectively, drew slowly forward to meet each other at Promontory Point, Utah, and kissed with their pilots.

*What was it the engines said,
Pilots touching, head-to-head,
Facing on the single track,
Half a world behind each back?*

Empire Building

With such vast distances to cover, Mr. Pullman came into his own. 'Palace cars' blossomed on the great transcontinental trains. In between them, grim and unrelieved, weaved the immigrants' trains, such as Robert Louis Stephenson described (*Across the Plains*). The Indians and the bison herds receded before the advance of the Bad Medicine Wagon. Steam was conquering continents.

Colonial railways began in Jamaica as far back as 1845. Upper Canada was penetrated, though it was not until 1885 that the Canadian Pacific Railway, after fearsome hazard, was got across the Rockies into British Columbia. India was laced with railways in the years after the Mutiny. At the Cape were the beginnings of what became the South African Railways, the largest and most efficient narrow-gauge system in the world. Australia made a mess over gauges, through interstate feeling. Queensland adopted 3 ft. 6 in., New South Wales the European and American standard of 4 ft. 8½ in., Victoria and South Australia built their main lines broad—5 ft. 3 in.—and Western Australia adopted 3 ft. 6 in. When at last, as recently as 1917, the Trans-Australian Railway was completed, it was on the 4 ft. 8½ in. gauge, which meant at first four breaks of gauge between Sydney and Perth, for South Australia had a narrow-gauge system as well as broad. We built railways in China. We built most of the great railways of the South American republics.

At home in England, the rail had begun to explore a new field in the 'sixties. The first section of the Metropolitan Railway was opened in 1863, and by degrees a large underground system was built up by this and the District company. It fumed with smoke and steam; nobody travelled on it for pleasure, though systematic patronage of the Inner Circle was recommended as a cure of asthma, and it solved the city traffic problems of thousands of Victorian travellers. It was the world's first underground city railway. In 1870 came our first deep-level line, or *tube*. It was a very small thing, the Tower Subway, under the Thames just above the Pool of London. One cable tram-car provided a service, but not for long. The car was scrapped and the tunnel became a footway, most confined and noisome, in which the frightened wayfarer could hear the thump of a ship's screw passing overhead. The tube idea was not new. Traction was the problem. Already the Pneumatic Dispatch Company had built a small-bore tube line for mails, in which the tiny cars were puffed through like peas in a shooter. An application of the principle for passenger transport was demonstrated at the Crystal Palace, but without practical consequences.

In the electric motor was the underground solution. A miniature electric railway ran at a Berlin Exhibition in 1879. In 1883, Magnus Volk opened the first British electric railway on the beach at Brighton, where it still is to-day, somewhat extended but minus a weird and wondrous sea-going extension to Rottingdean (the 'Daddy-Longlegs'), which was a short-lived prodigy of the end of the century. Very shortly after Volk's line, there was opened from Portrush to the Giant's Causeway, in Ireland, the first line in the world to run on hydro-electric power. It should be remarked that the Irish line used steam as well for many years.

Not yet did the electric railway go underground. In 1886 Liverpool and Glasgow acquired underground lines—the Mersey Railway and the Glasgow City and District—both with steam traction. Not until 1890 did the electric underground line appear, in the City and South London Railway, a tube which we still know in a much rebuilt and greatly extended form. Its first trains consisted of rather frightful cars with no proper windows, at once named 'Padded Cells' by the travelling public, and hauled by very small electric locomotives. The next two tubes—Waterloo and City in 1898 and Central London in 1900—set more familiar standards. Electrification of the old Metropolitan and District underground lines was not completed, however, until 1905. Following London's example, various foreign cities went underground, though in America there was for long a preference to build the city railways on trestles above the streets, adding a fresh din to the many noises of New York, and originating an entirely American sort of bedroom joke. The Liverpool Overhead Railway (1893) was our only 'Elevated'. It was electric from the first. In Scotland, Glasgow got its one and only tube, the District Subway, in 1896, but electricity was at first distrusted. The cars were cable-hauled until 1935.

The Great Bridges

Turning back to the British main-line railways, by the late eighteen-seventies these had, as already suggested, assumed a form very like that of to-day. But here and there remained great water-breaks. There were the Forth and Tay firths in Scotland. Between the nearer west of England and South Wales was the Bristol Channel. The gaps caused by the Scottish firths had resulted in the introduction of the world's first train ferries, suggested by Thomas Bouch and built by Napiers, at the end of 1849. But Bouch imagined greater things than these. He was indeed a man of more imagination than qualification, and the former ran in terms of giant bridges. His great Tay Bridge was opened in the summer of 1878. Eighteen months later, in the great gale of December 28, 1879, a monument of faulty design and shocking workmanship, it was blown down, taking with it the northbound mail train and about 80 people. There were no survivors except the engine, which was recovered and worked for 40 years after.

The subsequent findings were damning. Sir Thomas Bouch, as he had become, broke and died. His Forth Bridge, just begun, was abandoned. The very robust second Tay Bridge, designed by the Barlows, was opened 7½ years later, and stands to this day, sound as when it was built. The great cantilever bridge over the Firth of Forth, designed by Fowler and Baker to replace Bouch's abortive one, followed the second Tay Bridge in 1890. These things, with the completion of lines in the West Highlands, finished the Scottish railway system as we know it to-day.

Meanwhile in the South, after fourteen years of toil and recurrent accident, the Severn Tunnel was completed and opened under the Bristol Channel in 1886, furnishing a great cut-off on the Great Western Railway's main line from the Thames to South Wales. It remains the longest under-water tunnel in the world—4 miles, 628 yards. Only one other major British main line was built, the Great Central Railway's southern extension to London via Aylesbury, opened in March, 1899. Thereafter, additions to the British railway system consisted of branches and cut-offs, of which the completion of the Great Western's southern route to Exeter and Plymouth via Westbury, shortening the distance by 20 miles, came in 1906.

Thus three-quarters of the nineteenth century saw the virtual completion, from very small beginnings, of the British main-line railway system, and in most other countries much the same had happened. Many of the companies ran steamer services across the English and Irish Channels. One foreign Government, that of Belgium, returned the compliment on the Ostend-Dover run. The Canadian Pacific went in for ocean shipping on a grand scale. By rail and sea, steam spanned the world.

Mechanical advances and improved amenities were evident. Rails were made of steel. In 1891 the Great Eastern provided dining-car facilities for all classes of passenger on the York Continental trains. Ten years before, the Great Northern had introduced side corridors as a form of lavatory access on ordinary coaches. Now the Great Western put on the first complete corridor train, apart from Pullman trains, to run in Great Britain. Steam heat began to appear on express trains. The North Eastern built a sleeping car with single-berth compartments in 1894, and this gradually became the rule for British trains. Experiments had been made over many years with continuous brakes, but these, automatic in action, were made compulsory after a frightful accident resulting from a runaway on the Great Northern Railway of Ireland in 1889. The same legislation enforced the block system and interlocking. Third-class carriages were now sufficiently comfortable for there to be a decline in the demand for second class. The Midland had abolished it long ago; the Great North of Scotland never had provided it.

With the elaboration of passenger coaches, and the increasing weight of goods, locomotives were built progressively bigger. As a means to fuel economy, compound expansion had a vogue, largely initiated by Francis Webb on the London and North Western and T. W. Worsdell on the North Eastern, though the compound locomotive scarcely achieved the popularity which it enjoyed in some foreign countries, especially France.

Then there was the narrow-gauge phase. The first public narrow-gauge railway in the world, the Festiniog Railway in North Wales, dated back to 1836, but until 1863 it was worked by horses and gravity, up and down respectively. The Tal-y-llyn Railway, always steam, followed in 1865, but at the turn of the century it seemed as if there was to be quite a boom in narrow-gauge country lines. They had already been built in Ireland, where the standard gauge was broad (5 ft. 3 in.), and in the Isle of Man. Their use was spreading abroad, especially in Scandinavia, and parts of France and Germany. The delightful Lynton and Barnstaple Railway, on the very small 1 ft. 11½ in. gauge like the Festiniog, was opened in 1898; the Vale of Rheidol, on the same gauge, followed in 1902, and the Leek and Manifold Valley (2 ft. 6 in.) followed in 1904.

But already that had been loosed which would wreck the narrow-gauge

dream of opening up the remoter valleys. Noisy, smelly and fallible, target of police prosecution, the butt of endless jokes, the motor was in our midst. There is a quaint twist in the fact that Sir George Newnes, sponsor of the Lynton and Barnstaple Railway, was the same to the country motor-bus. Newnes's motor service, linking the L. and B.R. with Ilfracombe, did not last long. The Great Western Railway bought his two Milnes-Daimler buses and started a service between Helston and the Lizard. The G.W.R. motor services increased and spread widely as railway feeders during the succeeding thirty years. Several other railways, notably the North Eastern and the Great North of Scotland, did likewise during the reign of Edward VII. It is unrealised in many quarters to-day that the railways were the pioneers of the country motor-bus. This fact is not a string that independent bus operators harp on when singing of past glories. Newnes's venture, it should be remarked, was an associated undertaking of the Lynton and Barnstaple Railway.

As yet, however, the steam railways were scarcely challenged by land. They were far and away the fastest conveyance in the world. Competitive running between the East and West Coast companies in 1888, and still more in 1895, had given a great fillip to passenger-train speeds. It was demonstrated that start-to-stop average speeds of 60 miles an hour or over were entirely feasible, even on lines passing over such mountainous places as Shap Fell. In the early years of the present century it was likewise shown that a train might reach a maximum speed of 100 miles an hour without danger, conditions being right. From French locomotive performance it was seen that very high average speeds could be maintained without extravagant maximum speeds when using sufficiently powerful engines. The French, as remarked, favoured compound expansion to put down fuel costs. From Germany came the smoke-tube superheater, producing greater efficiency from the same amount of steam. Except on the Midland Railway, which produced a series of admirable compound engines, built over the first quarter of the present century, it was superheating rather than compounding that benefited British locomotive practice in the years more recently past.

End of Monopoly

In the years of Edward VII appeared a new, very serious competitor against the British main-line companies. It was not the motor. It was not the electric underground railway, which, as yet, kept within its metropolitan confines. It was the electric tram.

In London, it lifted millions of passengers from the inner suburban services. In Glasgow it did likewise, and kept them. Yet it was on Merseyside, where the competitors were ferry steamers, that the first British steam railway was converted to electric traction. That was the Mersey Railway in 1903. Certainly, the steam-worked Mersey had been, within its comparatively short stretch, the most fiercely reeking of all underground railways. Shortly after, the North Eastern did the same with its suburban lines north of Tyne, and the Lancashire and Yorkshire with its Liverpool-Southport line. They anticipated the largely underground District and Metropolitan lines in London. In the capital, too, the London, Brighton and South Coast company, assailed by the London County Council Tramways, electrified first the South London line, in 1909, and then the Crystal Palace group of lines. The Brighton company employed

alternating current at 6,000 volts with overhead contact, but this may be legitimately regarded as the beginning of the Southern electric system, which was eventually to cover nearly all the former L.B. and S.C. network and considerable portions of the South Eastern and South Western lines. The South Western company was responsible for the 660 volt d.c. system with third-rail contact, not faultless but still universal on British electric lines south of the Thames.

Abroad, electrification took on a different aspect. The Alpine countries, led by Switzerland, and Italy, had to import coal, but possessed tremendous reserves of water power. There electrification of main lines became a matter of national policy, and so it was in Sweden, also. Down the years, the Alpine passes had been undertunnelled, and the passage of miles of Alpine tunnel with steam traction was an experience not to be undertaken for fun. The older tunnels—Mont Cenis and St. Gotthard—were electrified in the course of the years. But the Simplon Tunnel, still the longest unbroken railway tunnel in the world, with over twelve miles, had electric traction practically from the beginning—from 1906 onwards—and the Lötschberg Tunnel has never known steam. In America, the Chicago, Milwaukee, St. Paul and Pacific Railroad electrified its mountain division in 1915.

War and Peace

The First World War put a tremendous strain on all railway systems which it involved. Road and equipment were worked to death, and were in poor shape to face the new, fierce competitor, the motor. Under war conditions, motor transport had, in its turn, arrived. The motor was no longer a ploy of the rich. It was everywhere, and a lesser thing than the railway would have crumpled before it, as, nearly a century before, the horse-drawn stages had faded before the railway. Local traffic declined, as it was bound to do, and some main-line traffic also. More and more suburban passenger services were electrified. In the nineteen-thirties, on British railways, express-train speeds were sharply bumped up, and, largely to please public fancy, that colossal sham, the streamlined steam locomotive, made its appearance. Let us not be too rude. As locomotives, the new engines were superb, and could reel off their hundred-miles-an-hour. On the long-distance runs the railways held much of their own, and in the violently expanding metropolitan area traffic greatly increased. The local country lines went down. Here and there were courageous attempts, and not unsuccessful ones, to hold traffic. A special bouquet should be handed to the County Donegal Railways which, with all the disadvantages of narrow gauge and a remote, sparsely populated territory, pioneered traffic by oil-driven railcars and so kept going.

America put the diesel—as it is generally called—on to long-distance traffic, yet few of us realised, in the nineteen-thirties, that it was destined to conquer steam on the American railroads. War came again. This second time it had a very odd effect on the railways of Western Europe, especially our own. Owing to the shortage of oil, civil motoring, whether public or private, was cut down to a minimum. How peculiarly pleasant and peaceful became the roads of England, even in South Eastern England with aeroplanes fighting across the sky, with bombs and blazing wreckage falling out of it, in that glorious, fateful late summer of 1940! But the same thing happened again. The railways carried

enormous loads of war material, goods and passengers, while maintenance went down to a starveling minimum. Moreover, the rigours of travel in blacked-out, overcrowded trains made the railway thoroughly unpopular with travellers, service and civilian alike. Many were the men and women who swore that if ever they fought their way out of this, never again would they use a train.

Yet the railways fought that war with the rest. Bridges, stations and trains were bombed, and the traffic kept moving. Railways on the Continent were devastated. They were rebuilt. Those of the Netherlands in particular, which had been literally torn to pieces by an enraged enemy, were rebuilt out of all recognition. There are the rails, triumphantly surviving to-day. It was a Socialist Government that, on principle, nationalised the British railways into British Railways, but in an era when the monopoly, for which they had been built, was no more, the thing was bound to come anyway. A first step had been taken after the previous war, when over a hundred companies had been amalgamated into four under the Railways Act, 1921. Eminent men had piloted the Big Four through the difficult inter-war years, men as eminent in their time as the Victorian tycoons had been—Stamp of the London Midland and Scottish, who pulled that huge, shaky edifice together, and whom nothing but high explosive could shift, as it tragically did during the war—and others still with us.

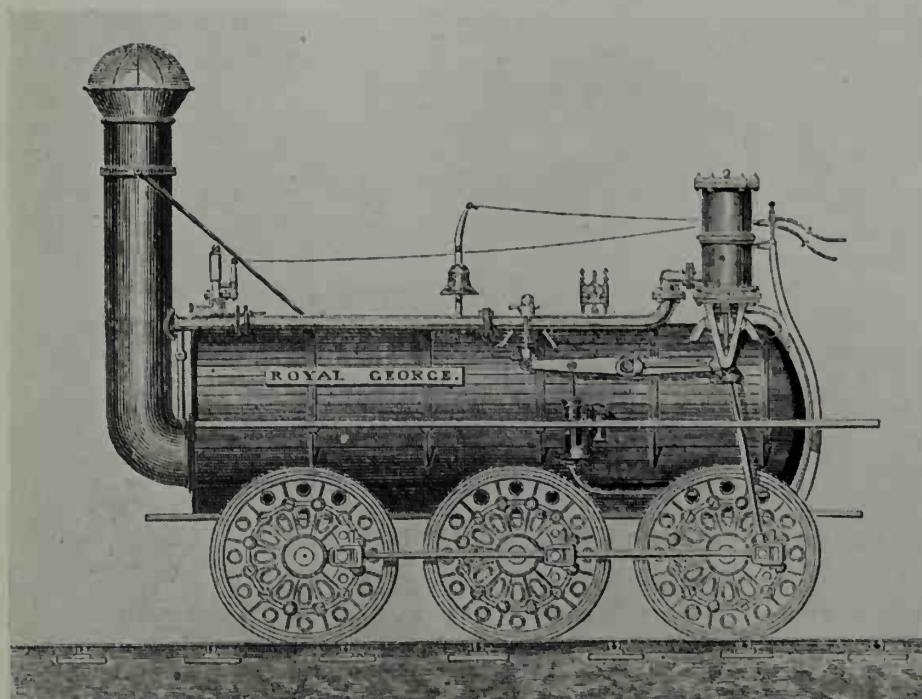
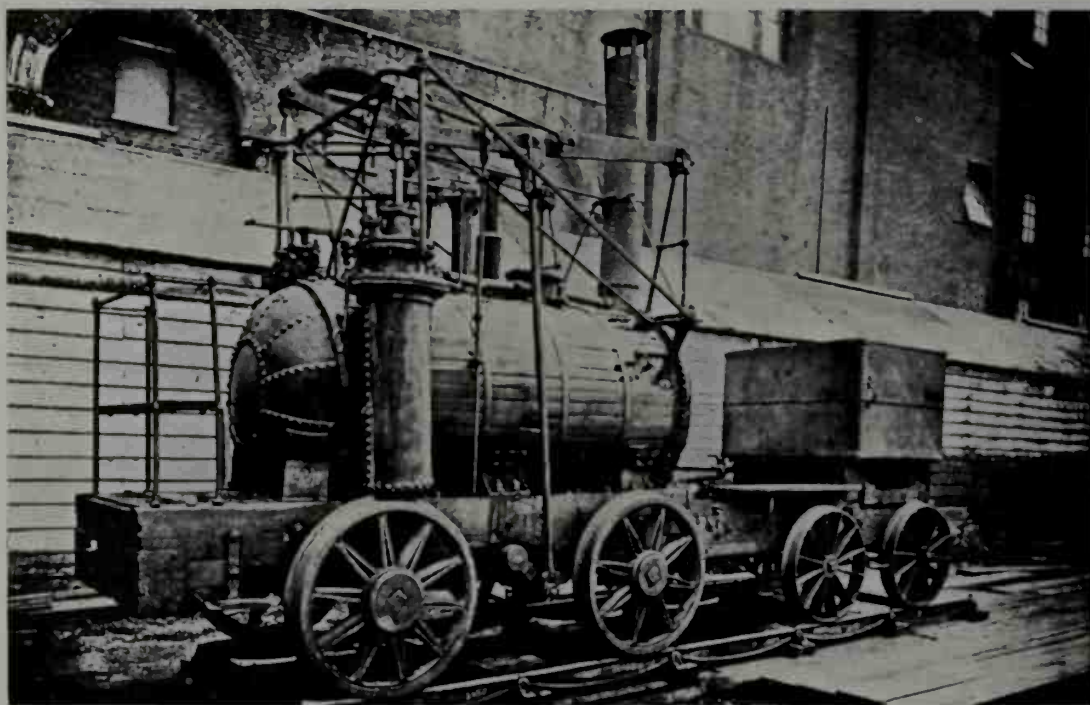
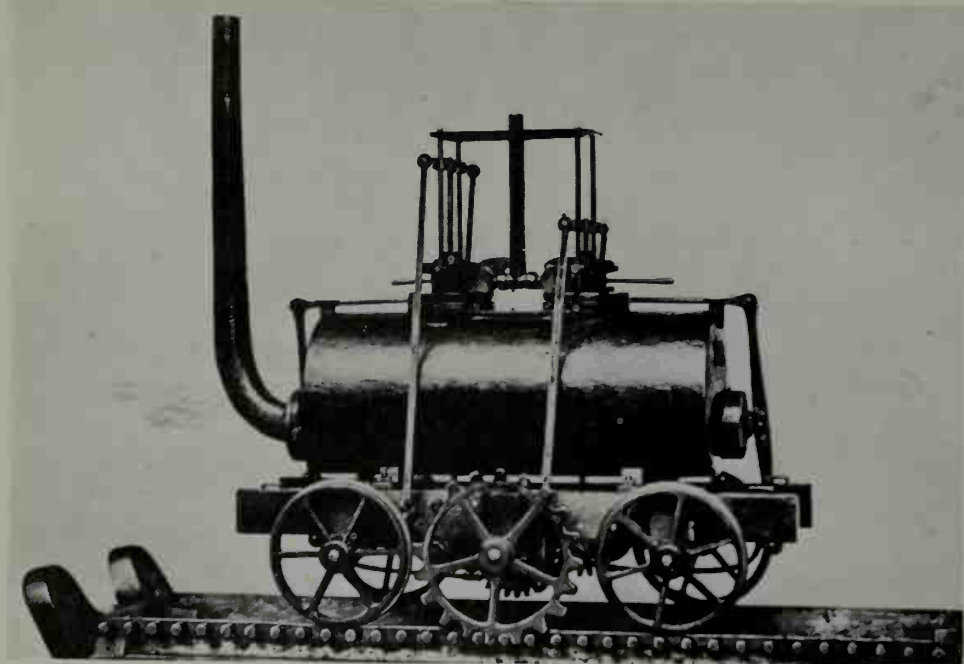
Forecasting is not your author's present task. He can only remark tendencies. Present tendencies became apparent after the war when British Railways completed the long-awaited electrification of the old Great Central line over the Pennines, with an entirely new tunnel through the very backbone of England. In 1955 came an announcement that no more steam locomotives would be built after a certain quota had been completed, and that on lines which did not warrant electrification the oil engine would take over as the years succeeded. We would have, we were told, new and splendid stations. We should have automatic train control, a form of which was indeed most laudably pioneered by the Great Western. The non-corridor compartment-type coach, honoured by nothing but time, would vanish from our local trains, where such survived. Freight would be moved at express speed. More and more would colour-light automatic signalling succeed the ancient semaphore. The railways would become, not a survival from the past, but truly part of a transport system to include the motor and the aircraft.

Who can forecast technical evolution beyond a certain point already indicated by tendencies? It is a risky way of achieving posthumous fame. Sir Isaac Newton, be it recalled, advanced the principle of jet propulsion at a time when the only things resembling piston engines were pumps and guns. H. G. Wells, with his superb observation, coupled with imagination, and with at least a perceptible seasoning of vulgarity, made forecasts which were astonishingly accurate. He made others which were not. But we have the belief that in the principle of railways, with its extraordinary capacity for the safe movement of millions of people and vast quantities of freight over long distances in little time, with its possibilities of still more improvement in automatic operation and control, some nameless genius invented something that may be fitly ranked with the wheel, the vessel and the wing.



1-3. In the beginning was the rail: Just when and where railways were invented, nobody knows for certain. Rutways were pre-Roman. Wagon-ways with flanged wheels to vehicles were used at least as early as the middle sixteenth century in Transylvania. The delineator (1773) of the middle cut here showed a plateway, but was not expert in drawing the plates. As far back as 1719, however, Louis XV at Marly-le-Roi was apparently conveying his guests round the gardens on edge rails in chairs, and had a handsome turntable outside his carriage shed (1). The view on the right shows the first conveyance of passengers by steam on rails, by Richard Trevithick's locomotive, *Catch-me-who-can*, in north-west London, 1808.





4-6. Matthew Murray's locomotives for Middleton Colliery, with the Blenkinsop rack-and-pinion drive, gave the first commercially successful application of steam to railways, in 1812. This (4) is a model in the Science Museum, South Kensington. *Puffing Billy* of 1813 (5) was the first to give satisfactory commercial service with a smooth driving wheel, at first on flanged and later on edge rails. She worked until 1862 when she was bought by the Commissioners of Patents, and is now at South Kensington. The lower figure shows Timothy Hackworth's *Royal George*, Stockton and Darlington Railway, 1827.

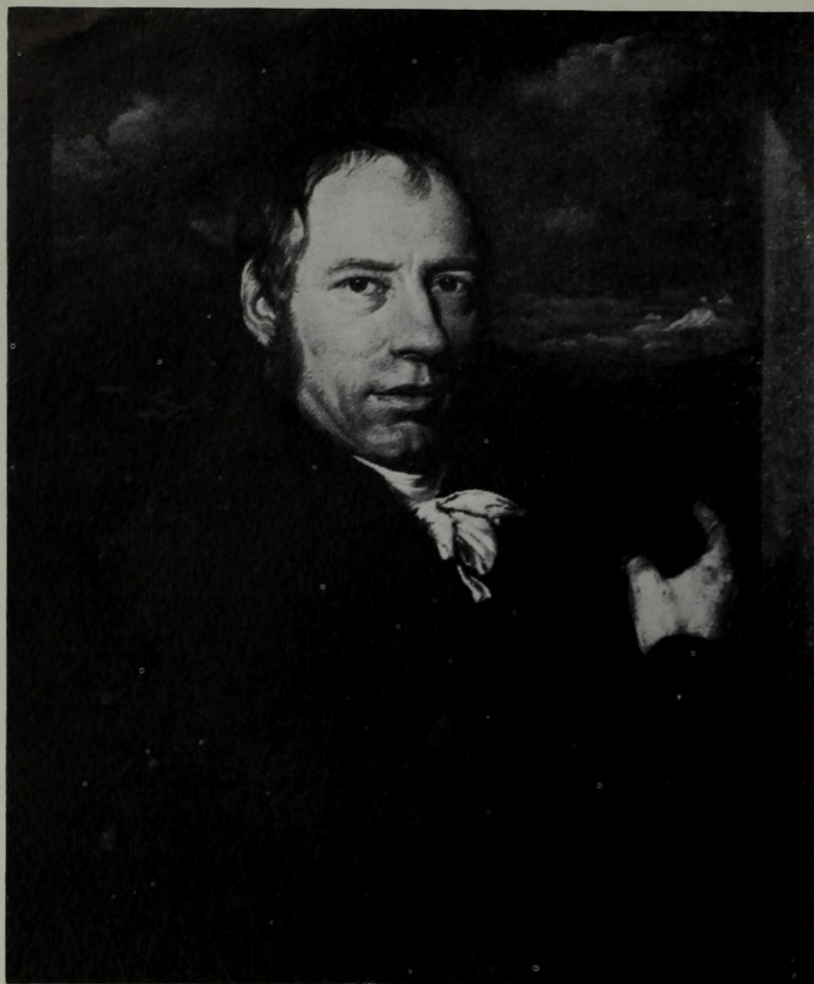
7. With the opening of the Stockton and Darlington Railway on September 27, 1825, public steam traction really began, though the passenger coaches were still drawn by horses in normal service. On the opening day, however, hundreds rode on the inaugural steam train, with George Stephenson driving his locomotive (afterwards named *Locomotion*). This is from a pencil drawing by J. R. Brown, of great beauty and probably made at the time.



8. The Canterbury and Whitstable Railway was opened on May 3, 1830, with one locomotive (*Invicta*). Over most of the distance, haulage was, however, by stationary engines and cables. Here, the inaugural train is thus being hoisted up to Tyler Hill.

9. On the Liverpool and Manchester Railway, opened in 1830, were many important 'firsts'. It was the first railway for which really heavy civil engineering work was undertaken. Its great viaduct across the Sankey Valley was the first of its kind in the history of railways.

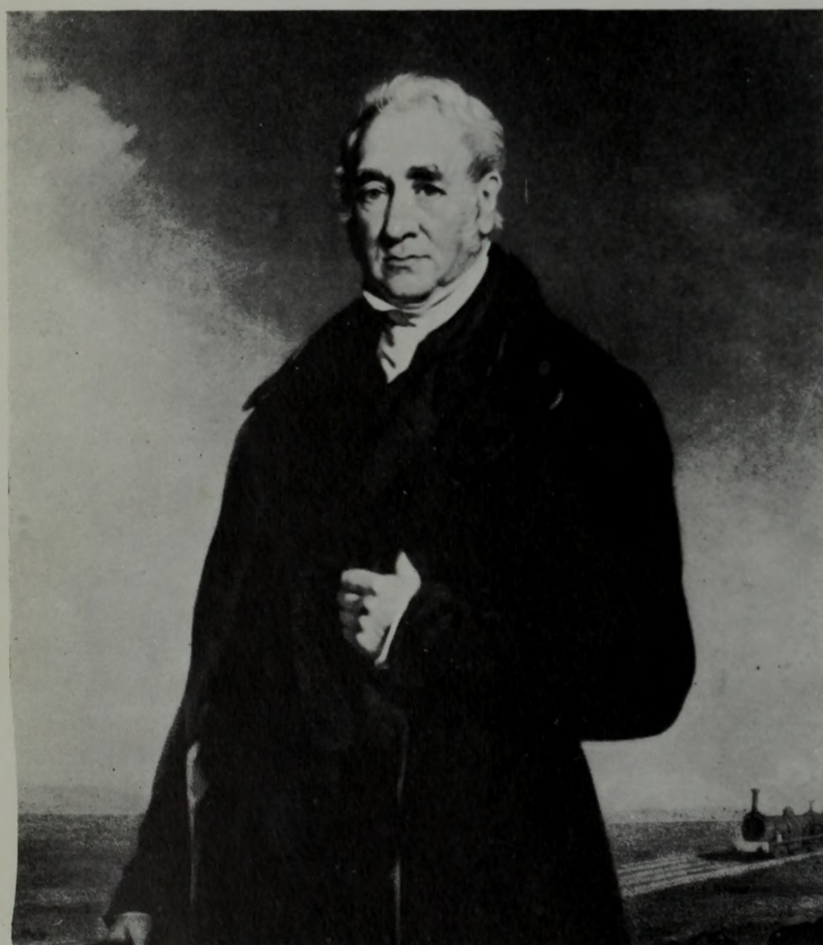




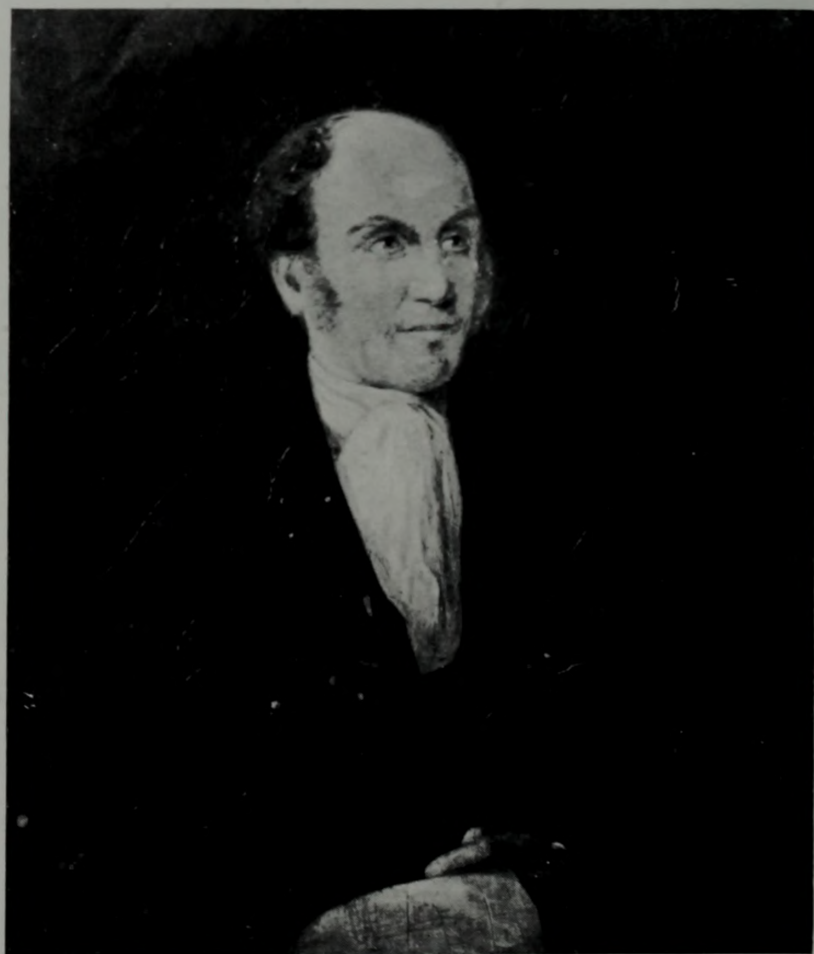
10. Richard Trevithick.



11. Marc Seguin.



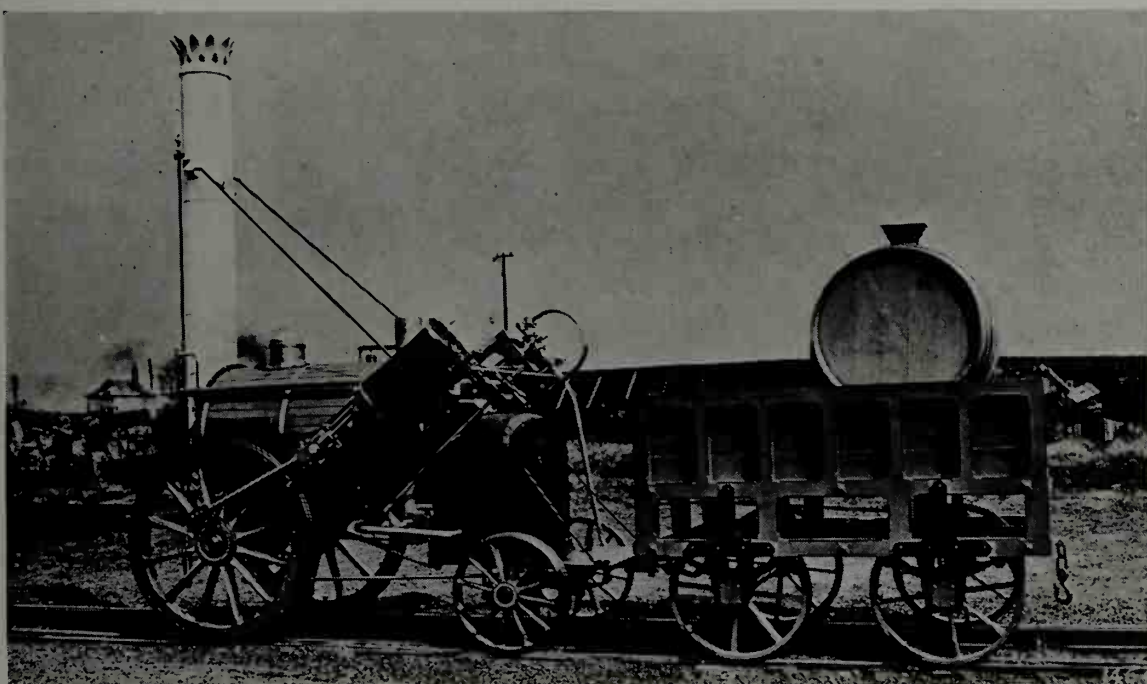
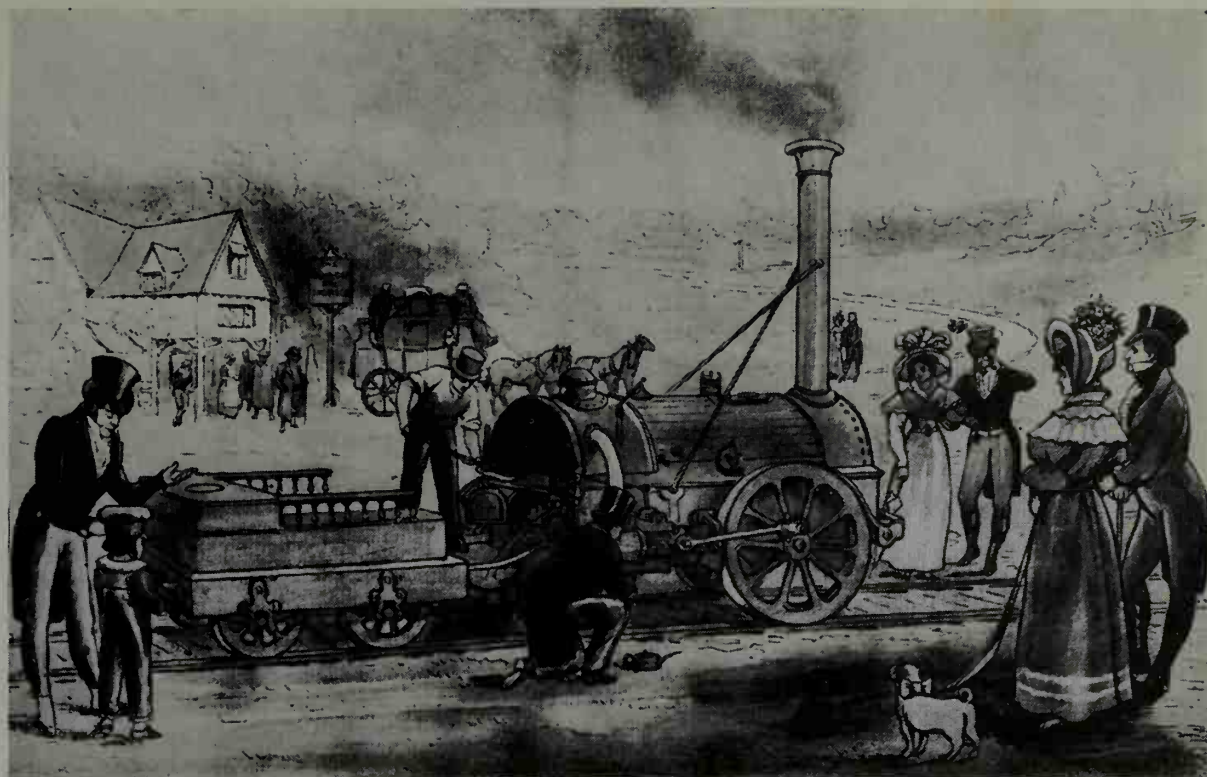
12. George Stephenson.



13. Timothy Hackworth.

THE AUTHORS OF THE RAILWAY ENGINE

14. This engaging scene is taken from a sketch made on the spot by James Nasmyth, just before the opening of the Liverpool and Manchester Railway. He described the engine as the *Rocket*, but it was in fact *Northumbrian*, without name-plates. Robert Stephenson is depicted firing, while George Stephenson nurses the right-hand cylinder.

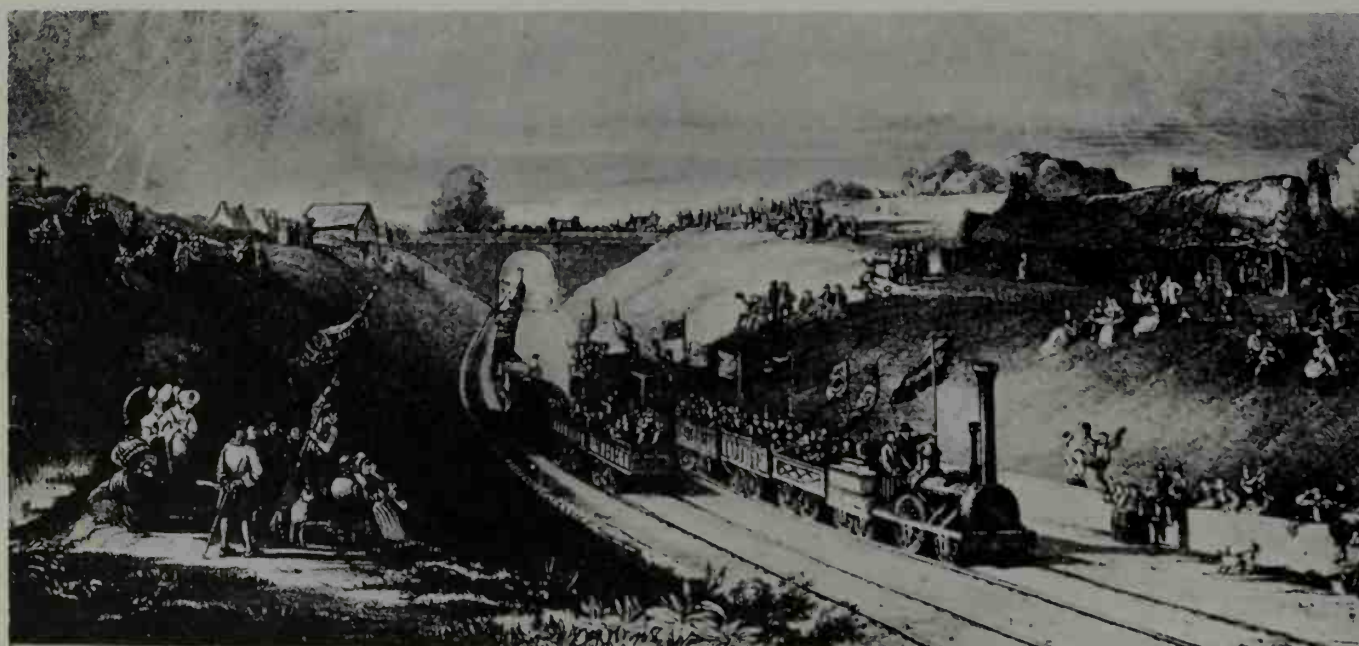


15. To this day there survives, at South Kensington, the shell of George Stephenson's *Rocket*. This working replica, made for Henry Ford in 1929, shows what she looked like a century before, in her prime.



16. Chat Moss on the Liverpool and Manchester Railway, c. 1831. Left is a Rocket-class locomotive with closed carriages; passing it on the right is a Planet class-engine with open 'common wagons'.

17. Advance, Liverpool and Manchester! A rare print of Edge Hill Station, about 1840, with an up train headed by a Dewrance locomotive. Porters are stowing luggage on the carriage roofs. The Victorian railway scene has taken form.



18. Scotland's rich Central Rift was bound to attract railway promotion. A beflagged train inaugurates the Garnkirk and Glasgow Railway in 1831, but, as befits a Scottish line, a well-laden goods train is already doing business on the other road.

19. On the Dublin and Kingstown Railway in 1834. The railway was made as elegant as possible, with flanking pavilions and a short tunnel where it passed through Lord Cloncurry's demesne of Maratimo near Blackrock.



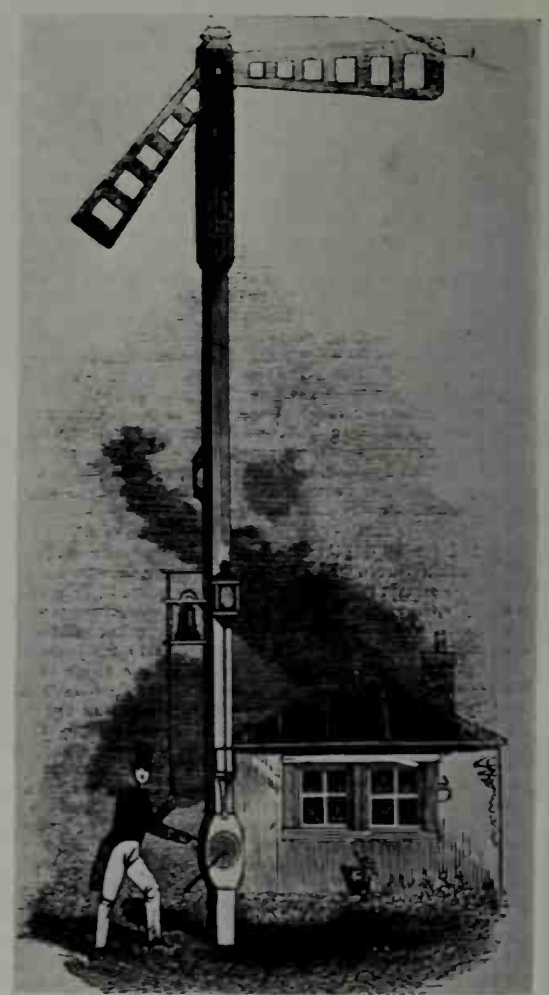


20. Calamity: France was visited with the world's first major railway disaster. On May 8, 1842, a double-headed up train from Versailles to Paris was derailed near Meudon by a broken axle, and caught fire. All the carriage doors were locked, and according to the official casualty list, 57 persons were killed. Plattel's painting is vigorously uninhibited as to detail. The leading engine, a Bury, would be out of the picture to the right, lying on its side. Part of the tender is visible in the foreground.

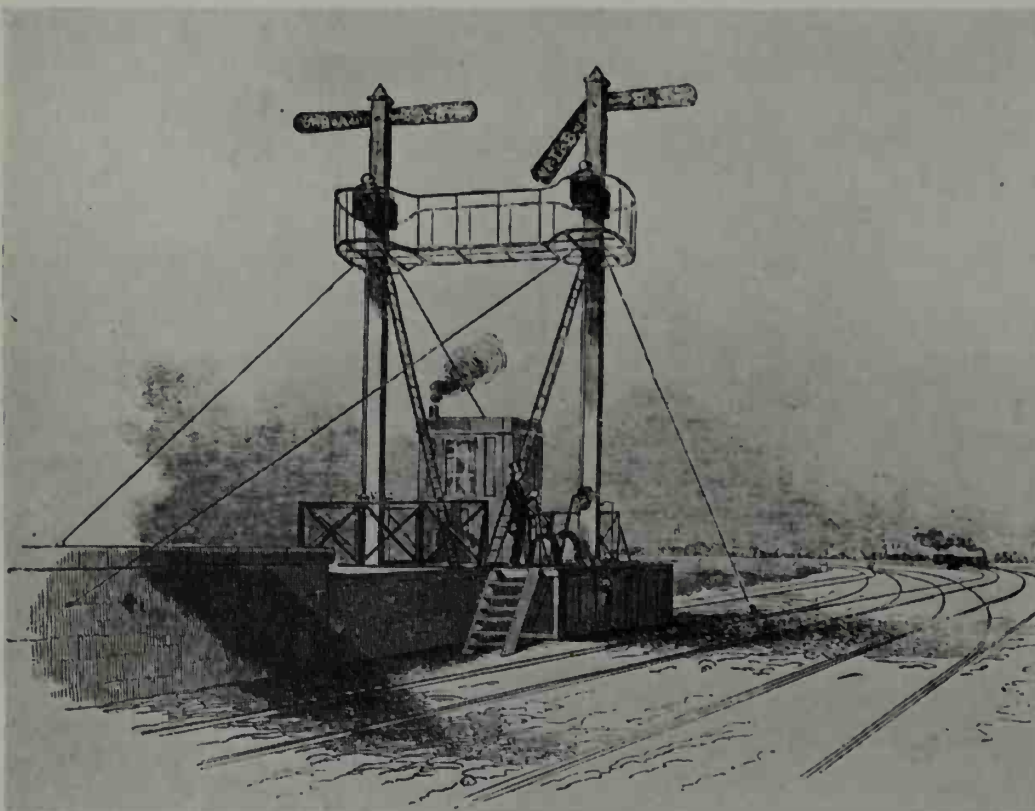


21-2. To the passengers, railway tunnels were variously annoying and terrifying. To the engineers, they were not only means of getting through intervening hills, they were monuments to the dawn of a new era, and were to be treated with such refinement as art could afford. Above is Fox's Wood on the Great Western; below is the northern portal of Milford Tunnel on the North Midland Railway.

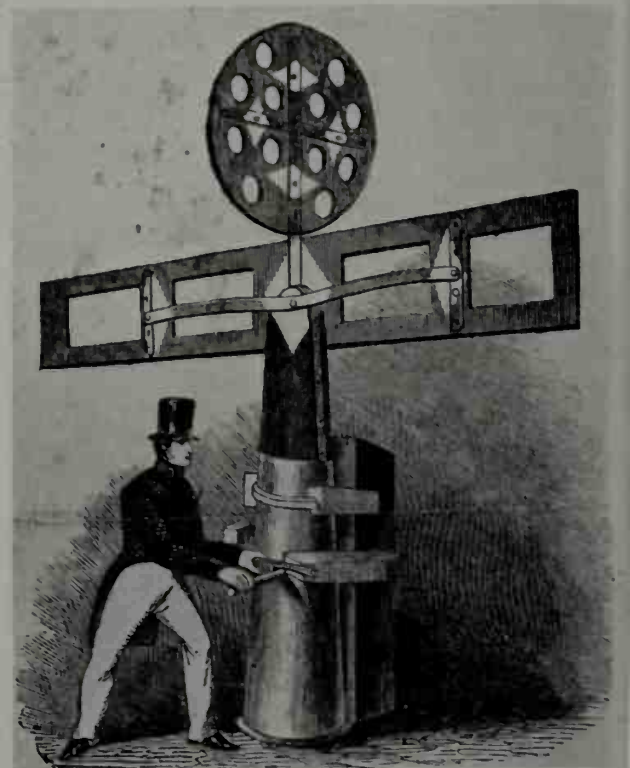




23-5. Primitive railway signalling was by police hand signals, though the semaphore was already well-known, invented by Chappe in the late eighteenth century as an early form of telegraph (the oldest was either the smoke signal or the drum). In the middle is Watson's semaphore telegraph station near London Bridge. It was destroyed in the Tooley Street fire of 1843. On the right is one of Gregory's first railway semaphores on the London and Croydon Railway at the beginning of the eighteen-forties.



26. Junction semaphores and locking frame at the divergence of the Bricklayers' Arms and London Bridge lines near New Cross in the middle eighteen-forties.



27. Various companies, especially in the West Country, used disc and crossbar instead of the semaphore. This form was usually mounted at the top of a very high mast, visible on straight track from a mile or more. This example was a junction signal, at low level, on the Great Western Railway.

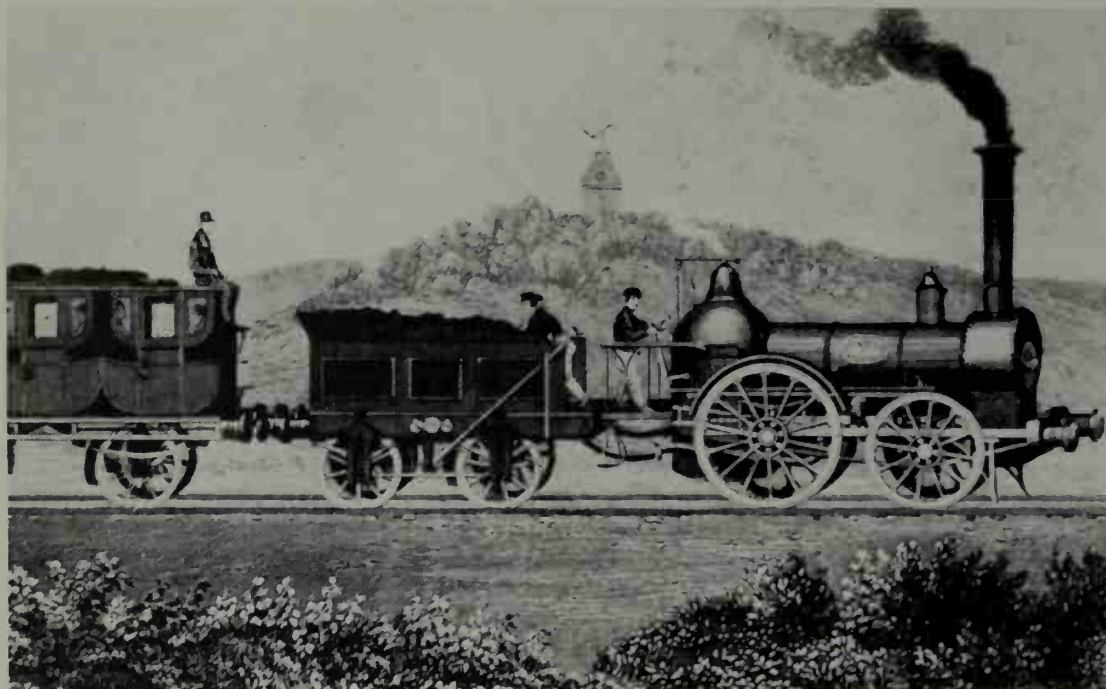


28. London and Birmingham Railway: Boxmoor Cutting being excavated. Horse-gins pulled the barrows to the top while the navvies steered, an extremely hazardous process.

29. In the construction of Kilsby Tunnel on the London and Birmingham Railway, the works encountered a quicksand, and the contractor died of shock. Robert Stephenson took over. This view shows the steam pumps he installed to deal with the flooded workings. Beyond is a large horse-gin for haulage.

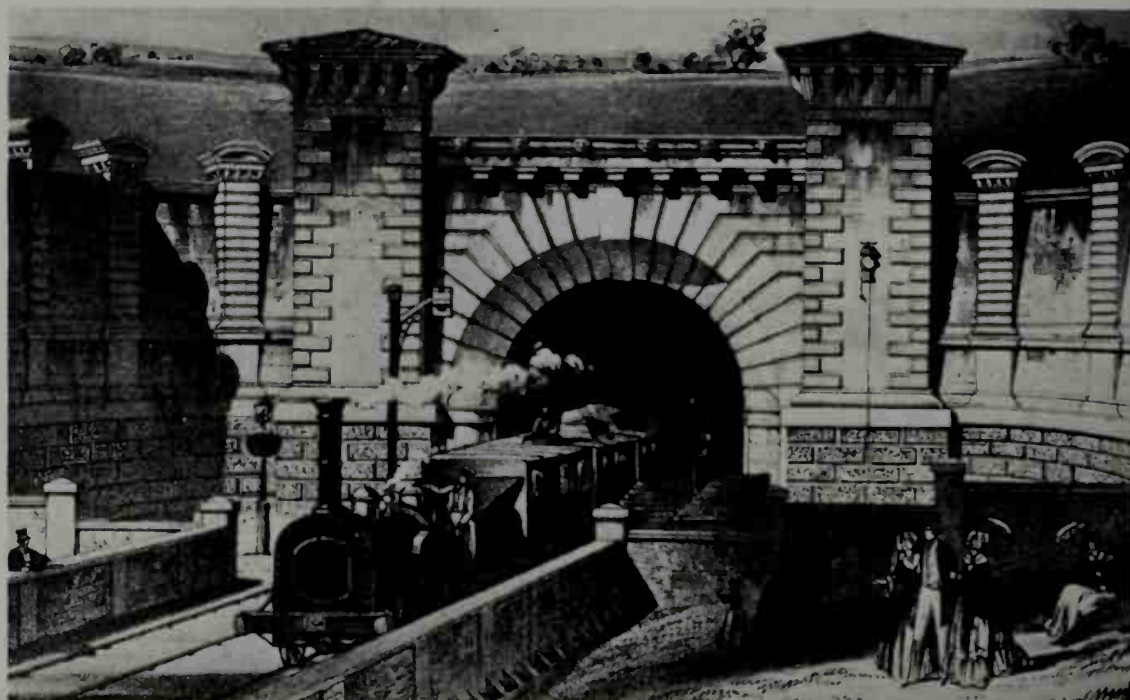


30. One of the great shafts of Kilsby Tunnel. A secret game of Rugbeians was to walk through the tunnel without being caught or killed.



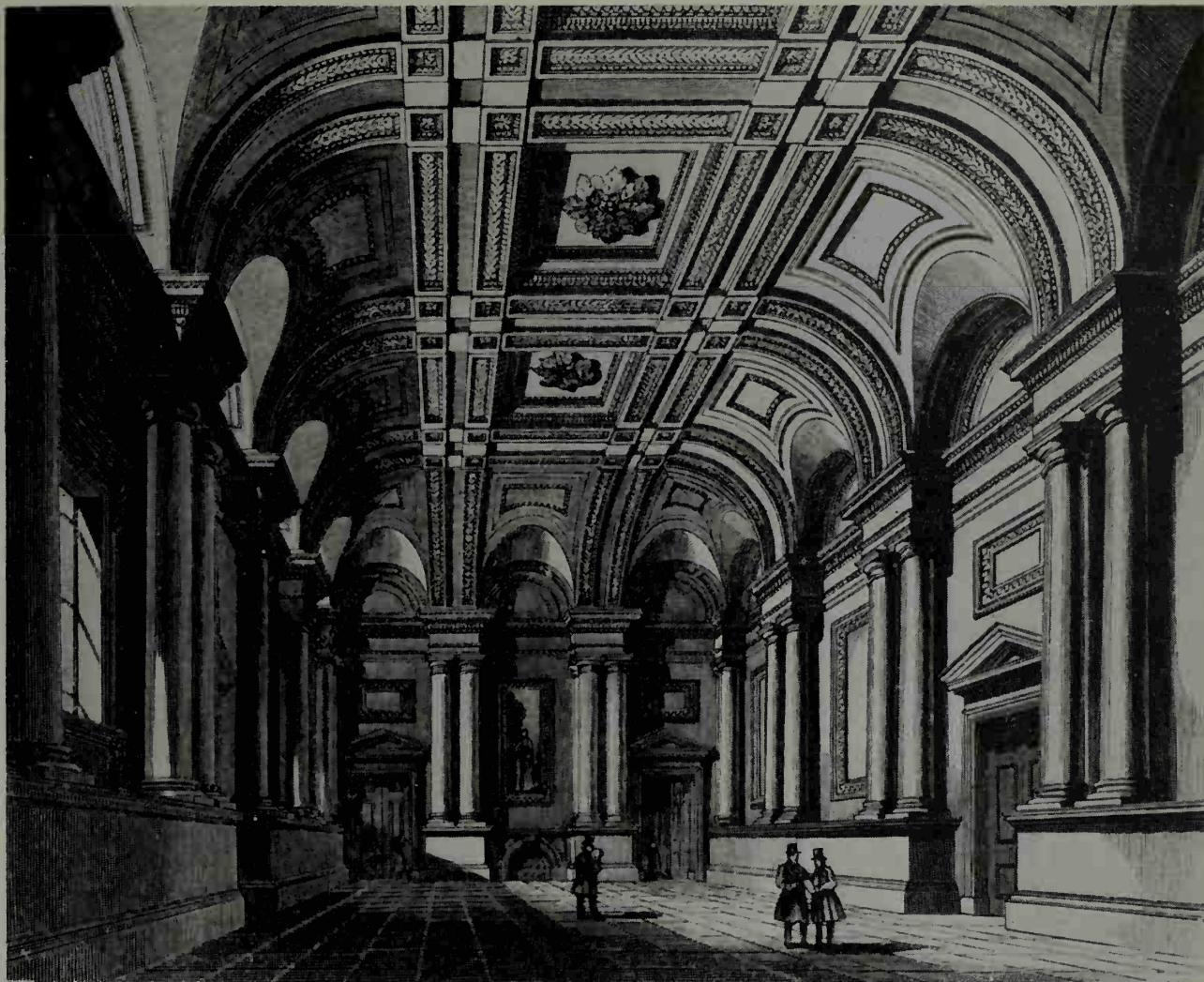
31. London and Birmingham Railway: One of Edward Bury's little bar-framed engines with which London's first main-line railway started business. The semaphore telegraph station on the hill behind, of Chappe's French type, is fictitious.

32. One of the sights of London's suburbia in the late 'thirties and early 'forties of last century was that of the London and Birmingham trains running in and out of Primrose Hill Tunnel. Behind the locomotive is an early fixed signal, and on the right-hand tower is a warning bell.



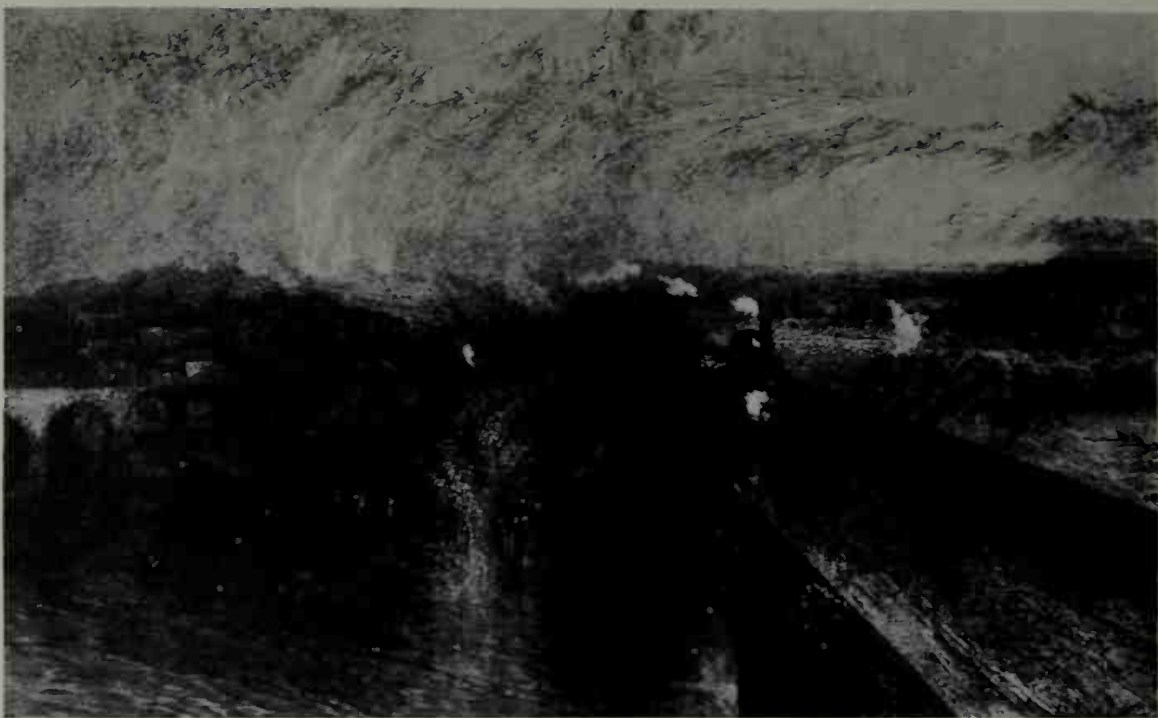
33. Pride of the London and Birmingham was Hardwick's Doric Portico at Euston, here shown as it appeared before it was screened, and its noble effect spoilt, by hotel extensions.

34. Less familiar, at Euston, than the Doric Portico or the Great Hall, but singularly beautiful, was the great Shareholders' Room by P. C. Hardwick.



35-6. Above are the Arms of the London and Birmingham Railway, in a unique mahogany carving; on the left is the regulator clock, installed at Euston in 1837, three months after the opening of the L. and B.R. All guards' watches had to be checked by it. To-day, the clock still keeps perfect time.

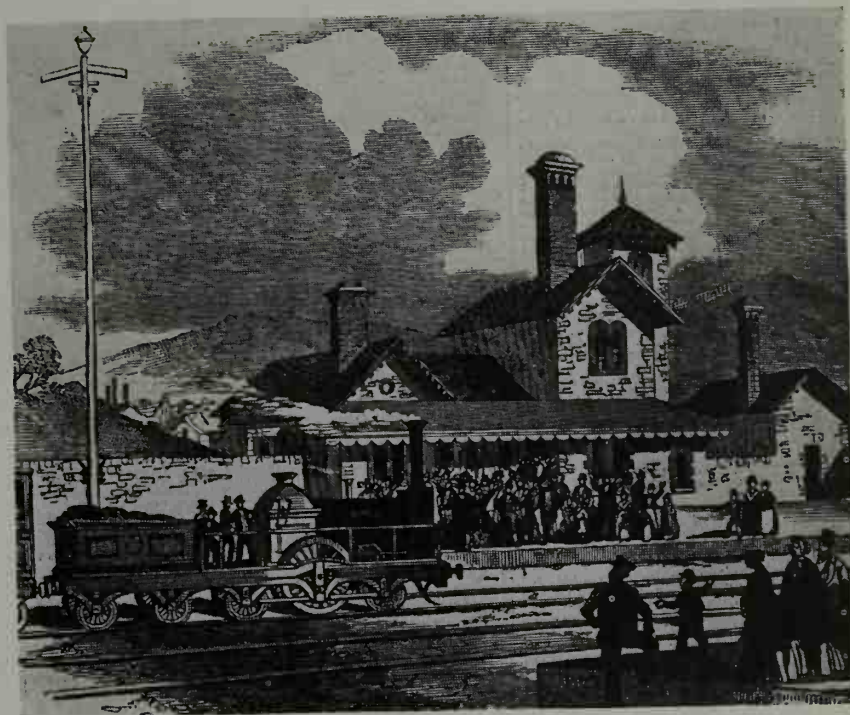
37. *Rain, Steam and Speed*: Brandard's engraving of Turner's painting, now in the National Gallery. A hare is running before the locomotive. The fiery blaze on the front of the latter has never been explained.



38-9. Viaducts took many forms; girders might rest on iron columns or on stone piers; Brunel's viaducts in the West Country and in South Wales were of timber, or had timber superstructures. Here, the upper view shows Meldon on the London and South Western Railway, and below is one of the smaller Brunel timber viaducts, at Dare.



40. A Sharp standard engine rolls out the Cork, Blackrock and Passage Railway, shortly before its opening in 1850.



41. A Stephenson engine brings the first train into Mallow from Dublin, Great Southern and Western Railway.



42. Victorian revival of Elizabethan architectural styles was apparent in many English railway stations. This was the Trent Valley station at Tamworth, at the end of the eighteen-forties. The locomotive was a Bury of the London and North Western Railway, Southern Division.



43. The Northern scene, at Holbeck, Leeds, in 1868. The engine backing up to the passenger station is one of the later Sharp singles of the Midland Railway.



44. Tyneside. This engraving (T. A. Prior after G. H. Andrews) shows Stephenson's and Harrison's High Level Bridge at Newcastle-upon-Tyne, seen from the Gateshead side. Andrews muffed the relation of light and shade to the rainbow; otherwise, it is a lovely picture.

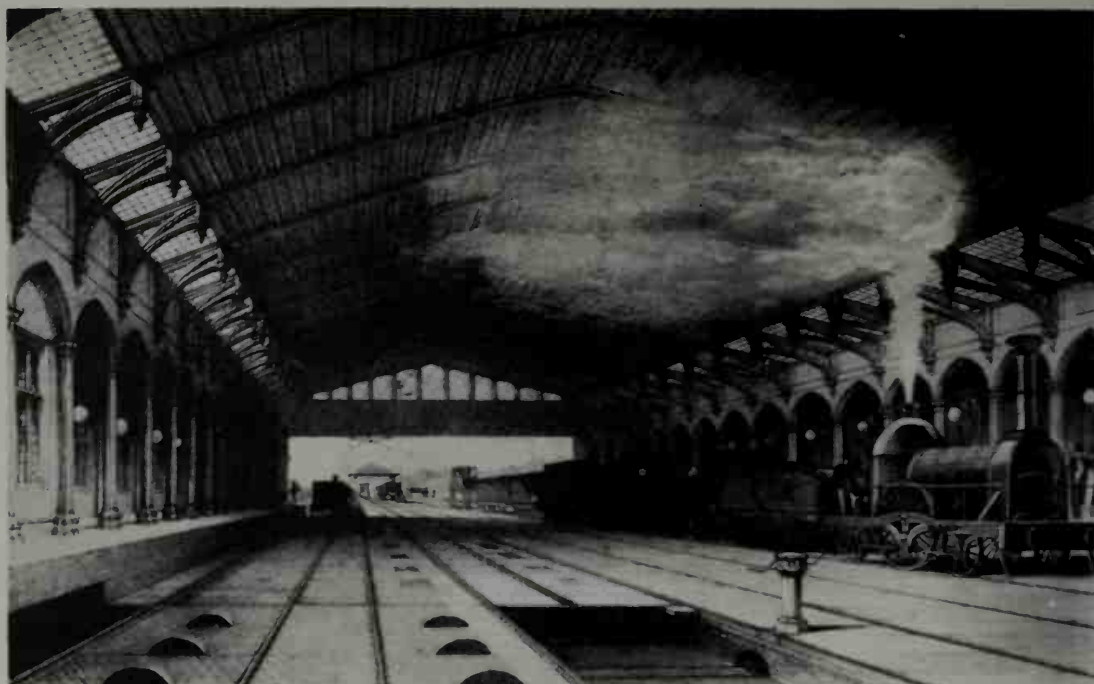


45. Industrial Revolution: Great railway viaducts brought a new, sombre dignity even to the landscape of a northern mill town. This might be a back-drop for Dickens' *Hard Times*. It is Stockport, with the viaduct of the London and North Western Railway.



46. At the same time, the main lines invaded the pastoral, High-Tory South. This view of Canterbury from the South Eastern Railway dates from 1846. The engine, a Sharp standard, appears to have blown something.

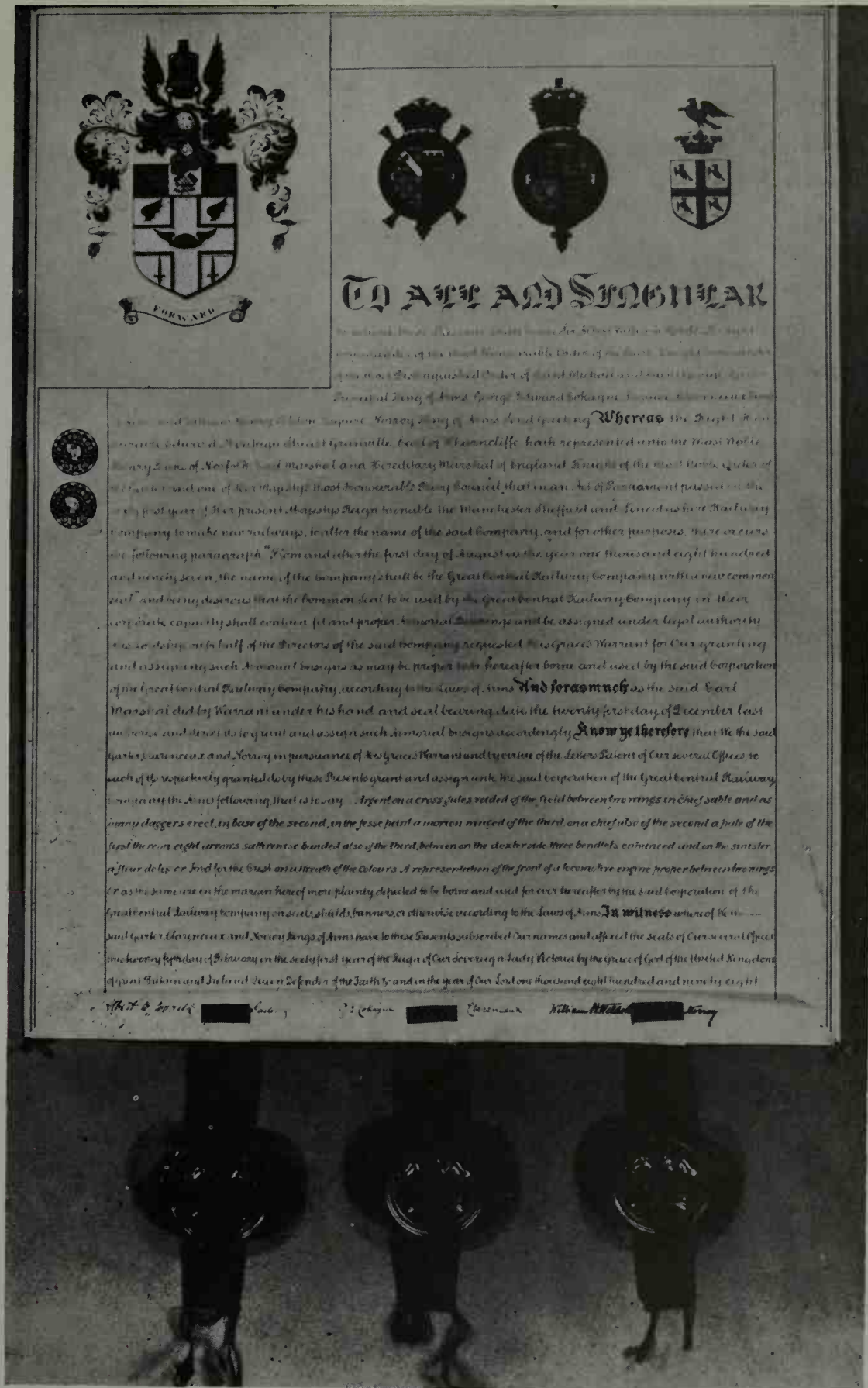
47-8. Early broad-gauge days on the Great Western: Bristol Temple Meads and Bath furnished really superb examples of stations having the all-over timber roofs associated with I. K. Brunel. The Bristol roof still survives, though forgotten of many in a greatly enlarged station.



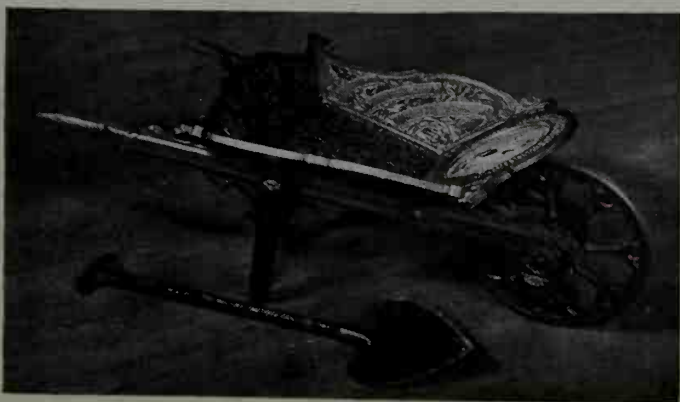
49. Passengers on the South Devon Railway make their Agag walk between trains after the sea has breached the causeway near Dawlish (February, 1855).



50. Seal of the Wigan Branch Railway, 1830. The engine is either *William IV* or *Queen Adelaide*, by Braithwaite and Ericsson.



51. From very early days railway companies liked heraldry. This, however, was a later example, the grant of arms to the Great Central Railway in 1898: 'Argent on a cross gules voided of the field between two wings in chief sable and as many daggers erect, in base of the second, in the fesse point a morion winged of the third, on a chief also of the second a pale of the first eight arrows saltirewise banded also of the third, between on the dexter side three bendlets enhanced and on the sinister a fleur de lys or. And for the crest on a Wreath of the Colours a representation of the front of a locomotive engine proper between two wings or.'



52. Ceremony was important. Barrow and spade used for cutting the first sod of the Stratford-on-Avon Railway, 1859.



53. First railway boom, in the eighteen-thirties: John Bull, quite drunk, throws his money about. Schemes vary from the rival Brighton lines of Stephenson and Rennie to 'Tunnel to the East Indies direct' and 'Steam Communication with the Moon'.



54. Railway Mania: The Railway Room at the Board of Trade, late in 1845, filled with plans for new railways. Another messenger of the hopeful comes to the counter.



55. Railway Mania cartoon in *Punch*: 'The Railway Juggernaut of 1845'.

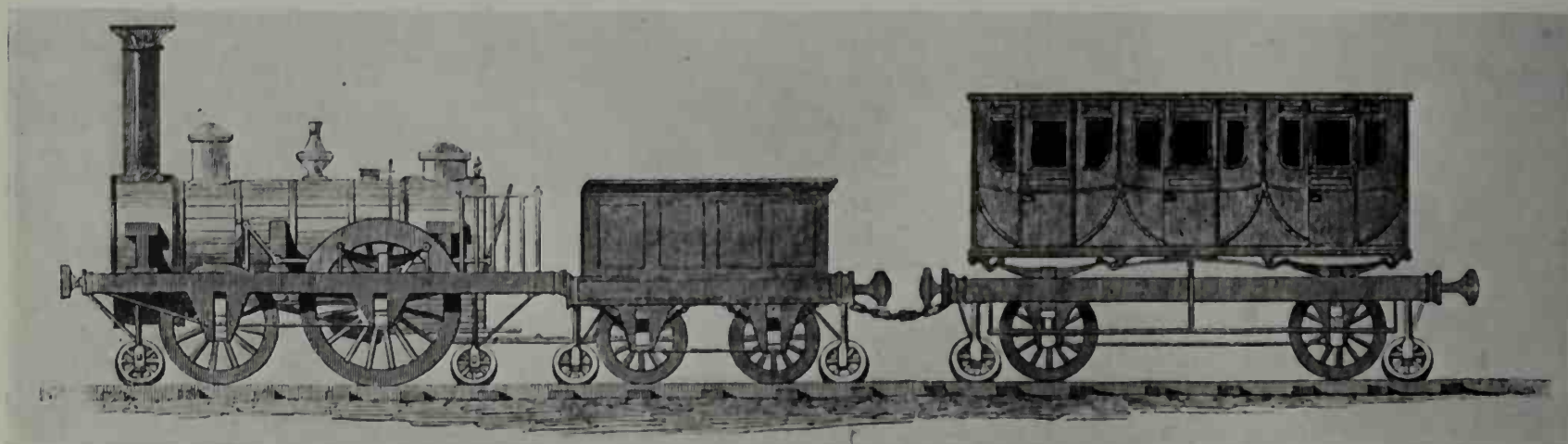
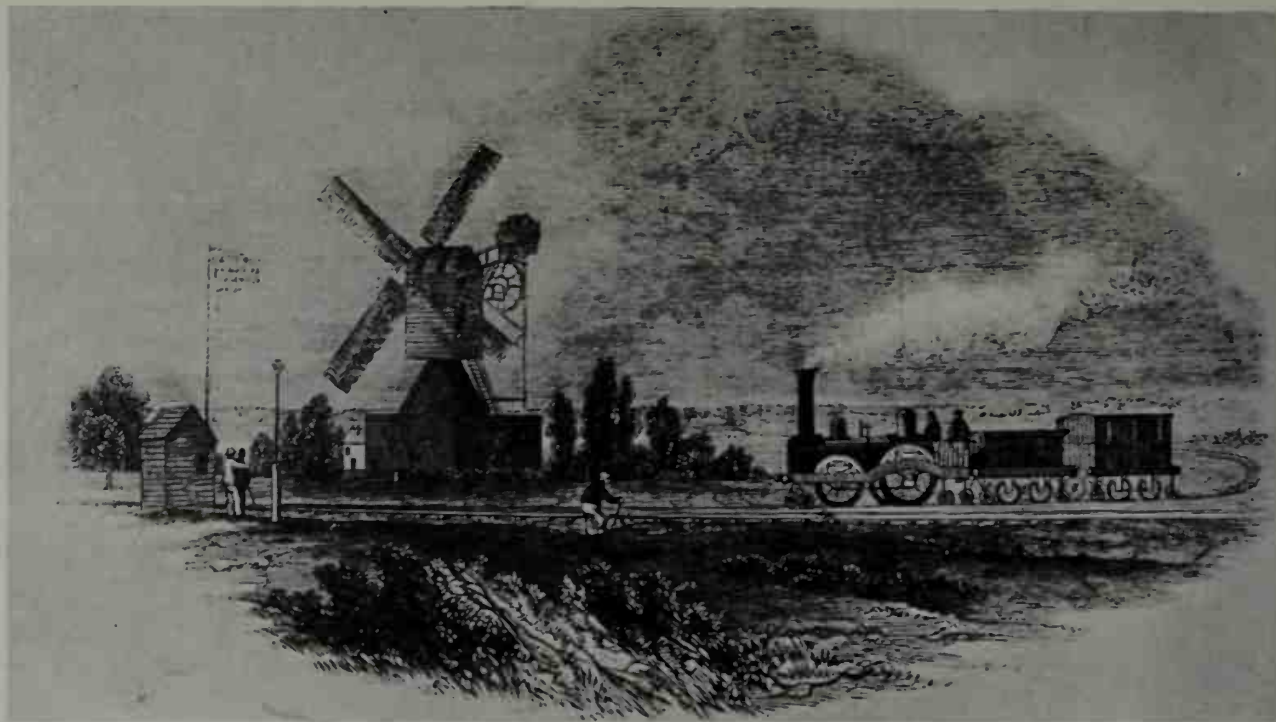


56. A little *lesé majesté*:
 'Tell me, oh tell me, dearest Albert!
 Have you any railway shares?'

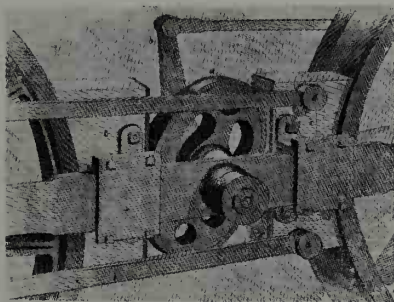


57. George Hudson, the Railway King, holds a levee.

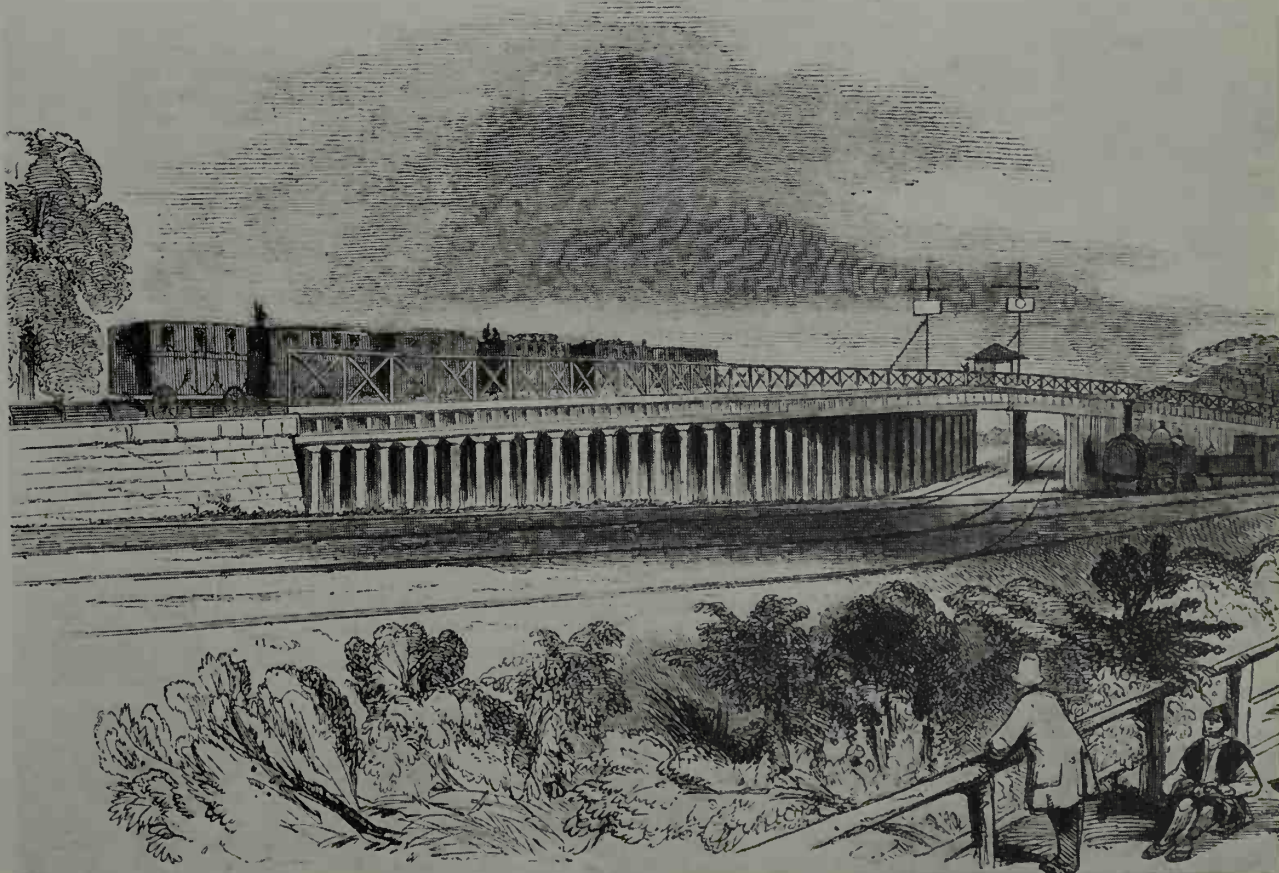
58-9. When railways were still a novelty, various sanguine inventors were already trying to improve and even to alter them radically. William Prosser sought to cut costs and sharpen curves by using wooden rails, with auxiliary guide wheels, instead of flanges on the main wheels. He proposed the system for a line to Portsmouth, but it got no further than an experimental section on Wimbledon Common.



60. Even Prosser's guide wheel was not a new idea. In France, Claude Arnoux had patented such a system as early as 1839, and the Paris-Sceaux line was opened with it in the summer of 1846, with 5 ft. 9 in. gauge. It worked thus until 1891. Here is one of the Arnoux engines. Only the driving wheels were flangeless. Carrying wheels were pivoted.

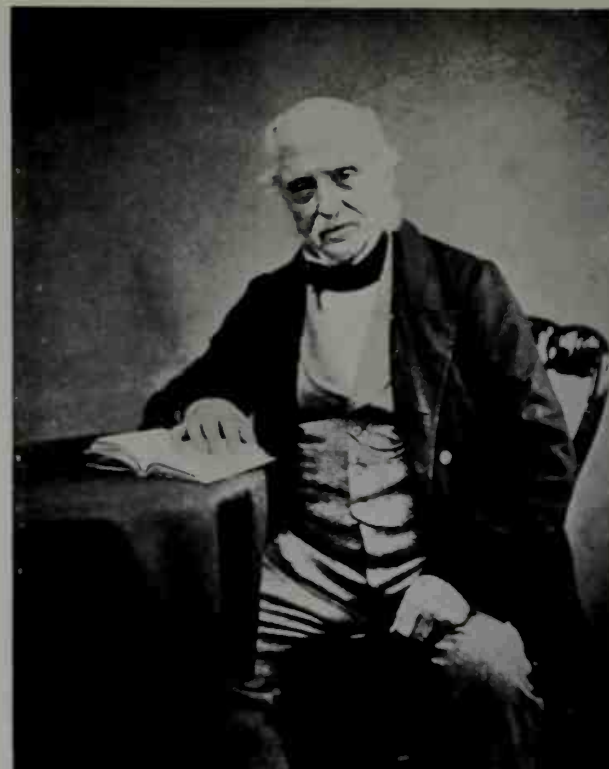


61-3. At once the boldest scheme and the biggest fiasco was the atmospheric system, tried, at great expense, on the London and Croydon, South Devon, and Dublin and Kings-town Railways. The trains were sucked along by means of a piston moving in a pipe between the rails, having a continuous slot valve with stationary engines, at intervals. Above is Norwood engine-house disguised as a church; in the middle, a cam-brake; and below, the world's first fly-over junction, near Norwood.





64. (*Above*) Thomas Brassey, the greatest of railway contractors. He built about 4,500 miles of route at home and abroad.



65. (*Above, right*) General Sir W. Pasley, the second Inspecting Officer of Railways at the Board of Trade.

66. (*Centre*) Miniature of I. K. Brunel, engineer of the Great Western Railway. It was given to Mrs. Brunel by the Lord Mayor of London following completion of the first Thames Tunnel, begun by his father, Sir Marc Brunel.



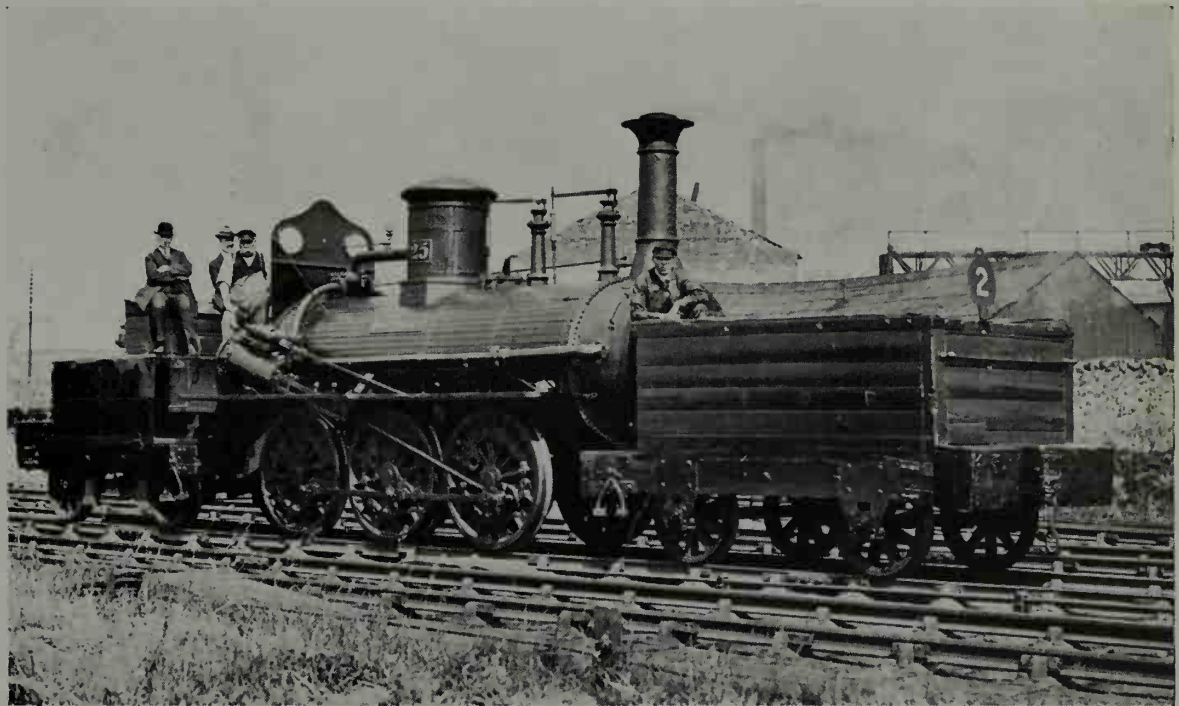
67. (*Below*) Sir William Cubitt, builder of the Great Northern Railway, President of the Institution of Civil Engineers, 1849-51.

68. (*Below, right*) Joseph Hall, an eminent British mechanical engineer, who took his art abroad. He commanded Maffei's works in Munich, and his practice had a lasting effect on Central European locomotive design.

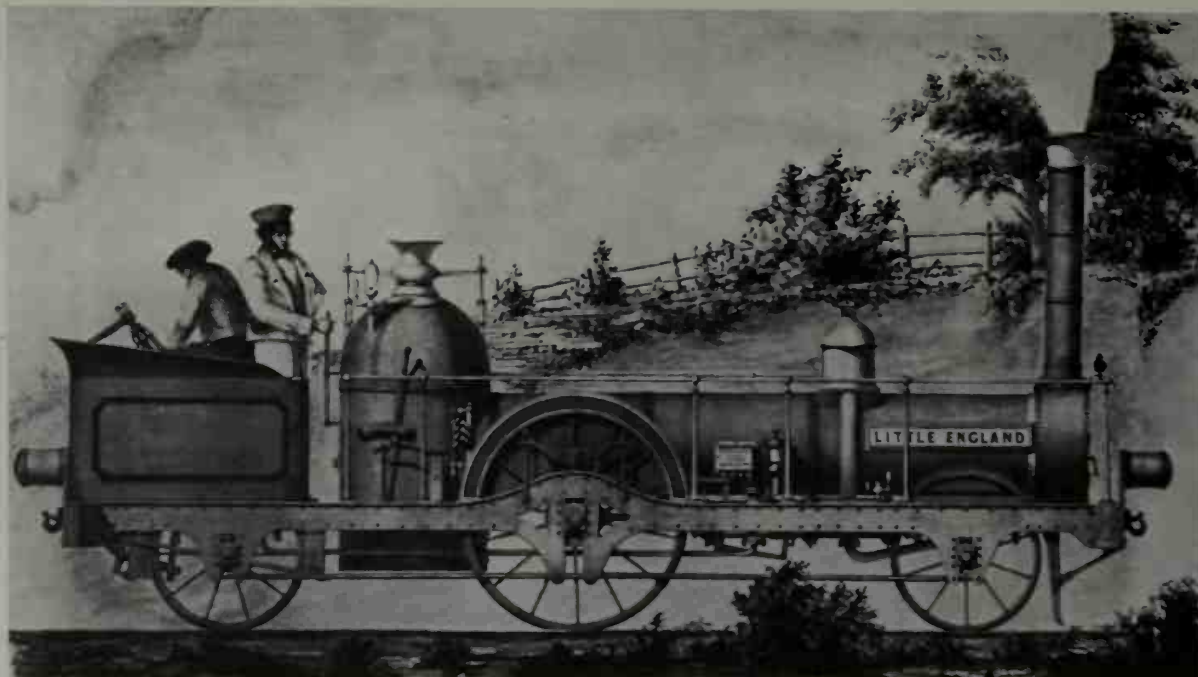




69-71. Early Victorian locomotive contrasts: One of the rare romances of British locomotive history was that of the Liverpool and Manchester engine *Lion*, built in 1838. She was sold to the Mersey Docks in 1859, became a stationary engine, and was resuscitated in 1929. Here she is filming in *The Lady with the Lamp*. On the Stockton and Darlington Railway (70) the influence of Timothy Hackworth prevailed for years. The *Derwent* of 1845 perpetuated the return-flue boiler, with firing done from the chimney end, and separate tenders for coal and water. A quaint feature was the mounting of the whistle on the steampipe. *Derwent* is preserved at Darlington, and still can steam. *Fitzwilliam* (71) was a typical mixed-traffic engine of the eighteen-fifties, on the South Yorkshire Railway.



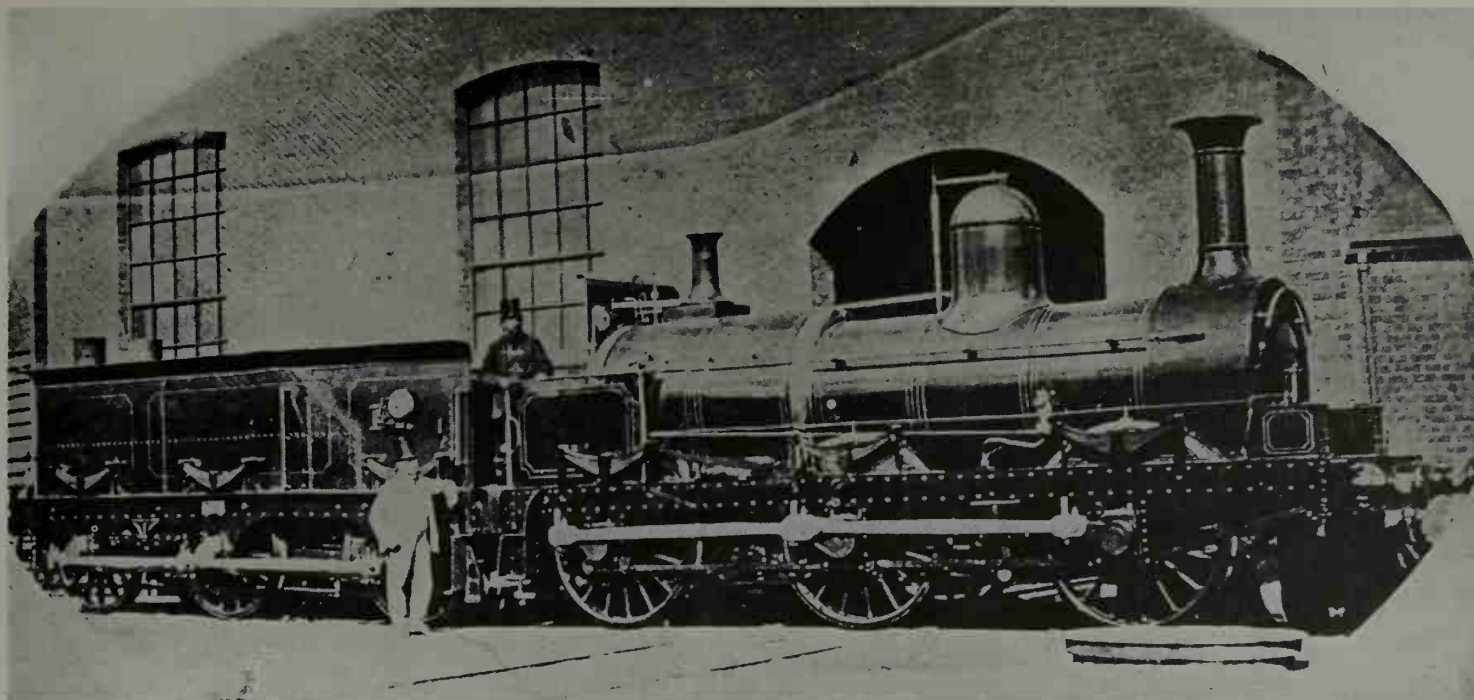
72. Early Victorian years saw plenty of experiments, intended to make locomotives other than they were. A favourite idea was that of the light unit. George England's *Little England*, shown in the Great Exhibition of 1851, was intended for fast running with very light trains.



73. Strange things were to be seen on West Country local lines, and the *Queen*, of the Torbay and Brixham Railway, was one of them. A very small broad-gauge engine, she was built by E. B. Wilson in 1852 and was scrapped about 1885.

74. This reconstruction shows a different sort of experiment, aimed at getting a perfectly balanced engine by the use of side levers. T. R. Crampton's *Lablache* ran trials on the Midland Railway at the end of the eighteen-forties. In theory she was perfect, but too much was expected of her, and her career was short and ignoble.





75-6. Mid-Victorian locomotive contrasts: Above is a Sturrock goods engine of the Great Northern. She has an auxiliary steam tender with cylinders and coupled wheels. In the middle is the Leamington branch engine of the London and North Western in the 'sixties, one of McConnell's 'Small Bloomers'. The 'Bloomers', small, large, and extra-large, got their name from their historical coincidence with Amelia Bloomer's efforts in dress reform; their much-exposed wheels further suggested a leg show.

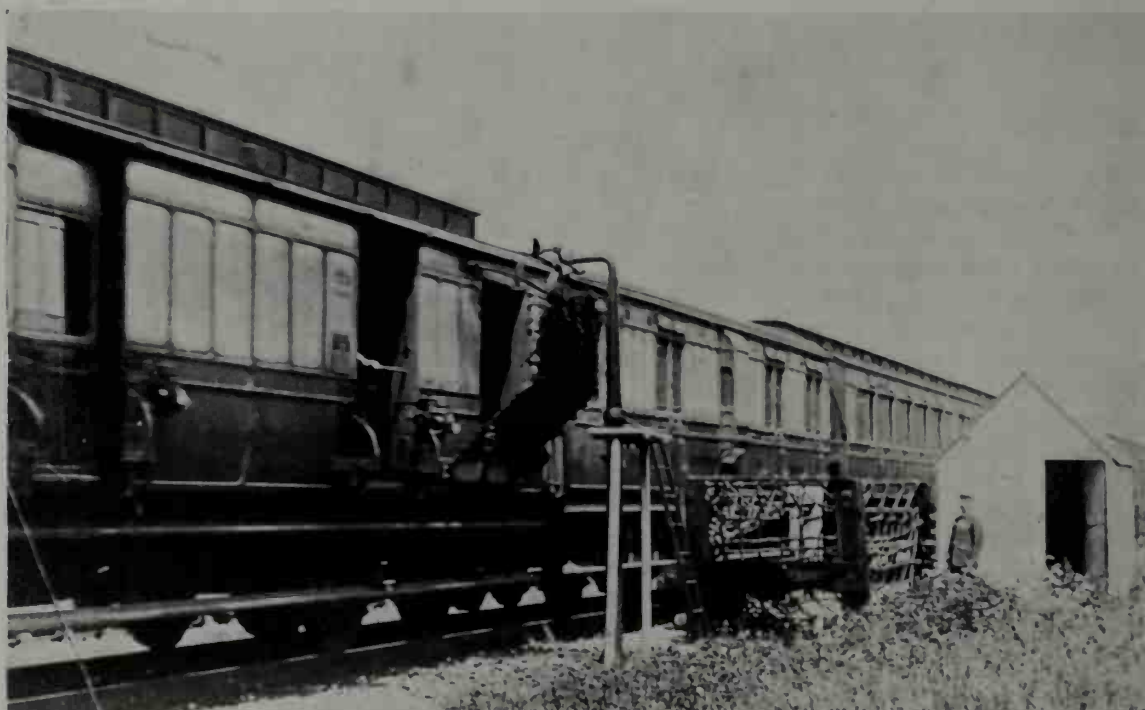


77. Suburbia in the 'sixties: North London Railway train, headed by a Slaughter Gruning 4-4-0 tank engine.



78-80. Travelling Post Offices, so often claimed for America, began on the Grand Junction Railway in 1838. The two upper views show a restoration of the first Birmingham-Liverpool special T.P.O. with Ramsay's apparatus for exchanging the mail pouches at speed. On the right, pouches are being exchanged on the Great Western Railway, c. 1900.

81-2. The earliest form of sleeping berth on British trains (1838) was furnished by the bed-carriage, and involved a cushion laid on a stretcher across the footspace. The specimen below was mounted in Queen Adelaide's special carriage on the London and Birmingham Railway. On the right is a well-upholstered lavatory and pedestal cupboard combination which the Great Western furnished for Queen Victoria's carriage, possibly as far back as 1850.

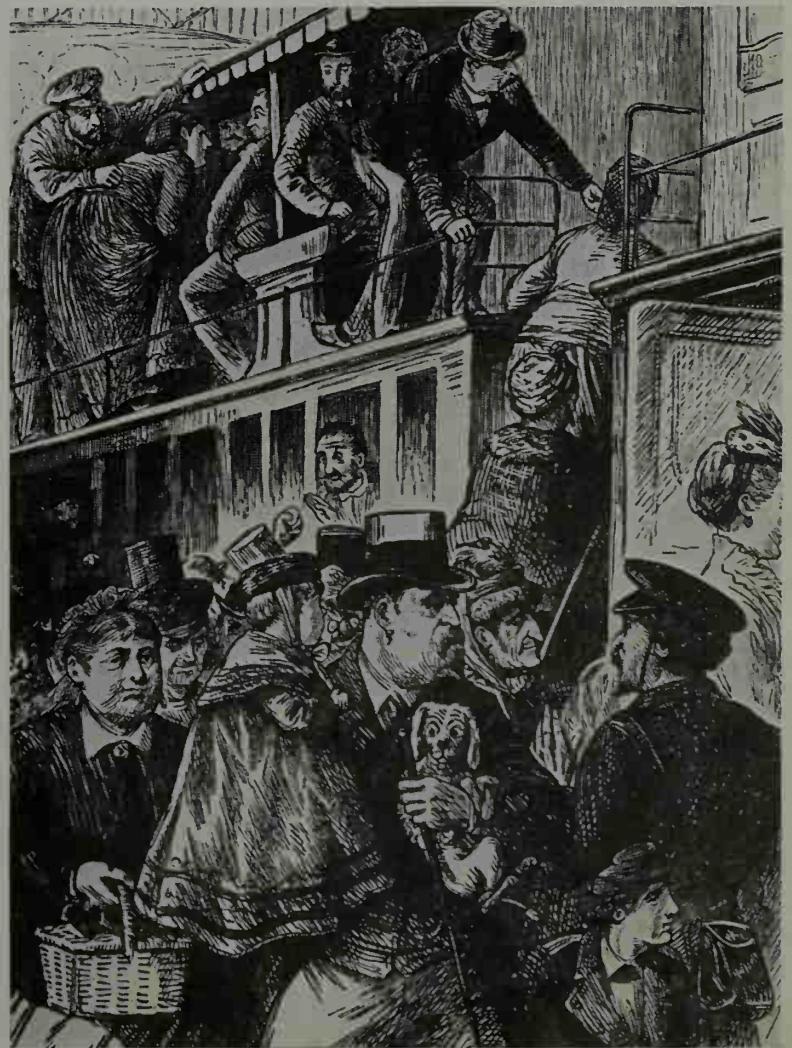




83-4. Patrician and Proletariat: The girl of the 'sixties sits sideways in crinoline, her hoops showing plainly through her skirt. No extravagance of fashion was ever a greater nuisance in travel. The fourth-class carriage above (1856) was an ornament of the London, Brighton and South Coast Railway; this scene is a remarkable example of a posed pseudo-instantaneous photograph.



85-6. Abroad: The Doyle drawing shows the midnight impact of a German policeman requiring passports, probably during the war of 1866. The French scene is later in the nineteenth century, but the semi-open double-deck suburban carriages lasted for many years into the twentieth.



87. Maintaining dignity: Waterloo main-line arrival platform in 1870. Beyond the sad-faced widow on the left is a creditable representation of a Beattie locomotive of the London and South Western Railway, with its tubular feedwater heater and donkey pump. A coachman respectfully greets the old parson with the dowdy daughter. From behind the nearer pillar, a sinister face watches with satisfaction the arrival of somebody's little sister from the country.



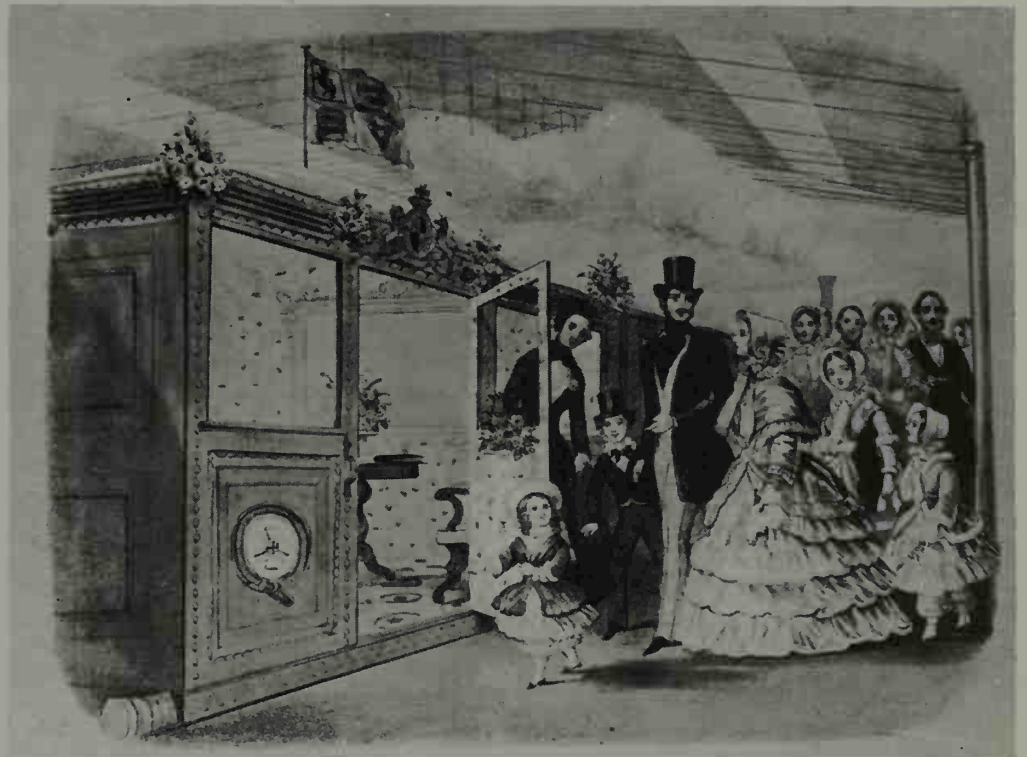
88. Losing dignity: Crystal Palace Low Level on the London, Brighton and South Coast Railway, at the end of a fête day in the 'sixties. There were first-, second- and third-class bookings, but the two nearer carriages are fourth-class excursion stock, open above the waist. The crowd in the drawing is behaving as crowds always have done; the lady on the extreme right has burst her crinoline (see 83).

89. Anxiety: Snowed up on the South Eastern Railway, January 18, 1881. All the four southern lines, and a large part of the Great Western, were paralysed within a couple of hours.

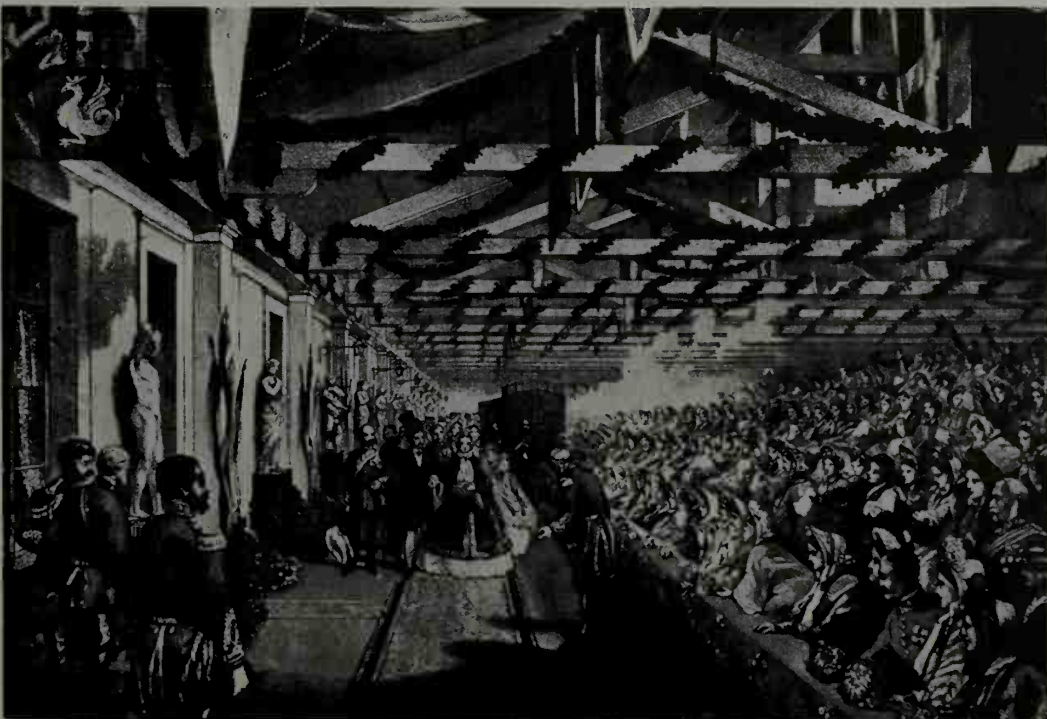




90. 'Leaving Home': Jeans' engraving after H. Holl, A.R.A. The young widow, apparently considering her last shillings, commands her tears; the young soldier, about to leave his mother, endeavours to do the same, while keenly aware of the old sweats in the doorway. Advertisements are for the London and South Western Railway, and for Mr. Dickens' new novel, *Nicholas Nickleby*.



91. Queen Victoria, Prince Albert and the royal children leave for Scotland by the Great Northern Railway in 1852.



92. The arrival of the Princess Alexandra of Denmark, newly married to the Prince of Wales, at Bricklayers' Arms, South Eastern Railway, on March 7, 1863.

93-4. The Queen's carriages. These two photographs show Queen Victoria's day saloon and bedroom on the London and North Western Railway's royal train, 1869. Day car and sleeper, rebuilt as a single long vehicle without bellows, have survived. In them the Queen made all her journeys to and from Scotland in the latter part of her life.

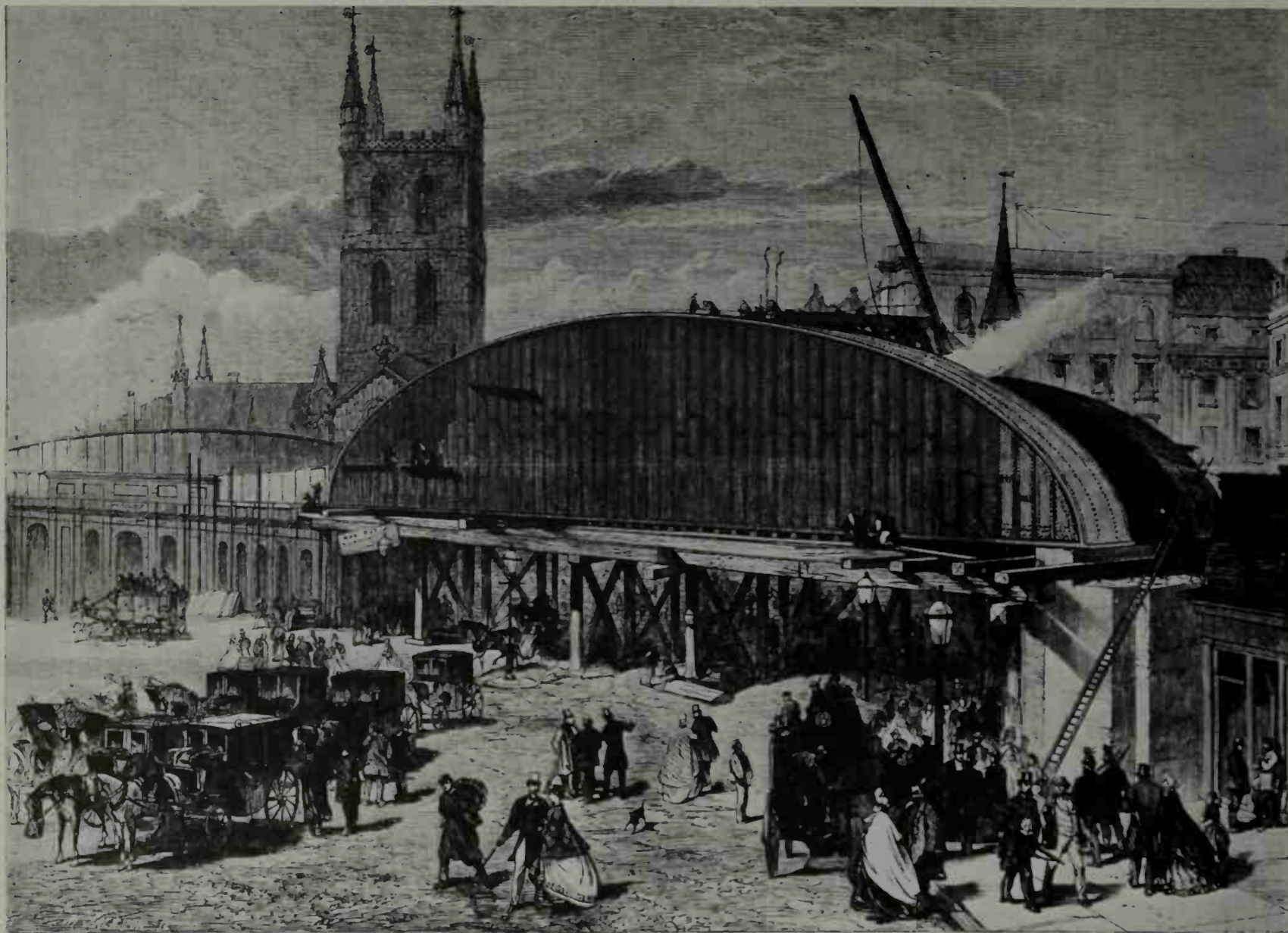


95. This carriage was built for the Queen by the Great Western Railway in 1874. It was on the G.W.R. that she had made her first railway journey, in 1842. The 1874 carriage was on eight wheels and was of standard gauge. The Queen liked it so much that she never again travelled on the broad gauge.



96-8. Robert Stephenson was required to make his tubular bridge at Conway belong, in Victorian estimation, with the Castle. The upper view shows the bridge under construction, with the second tube being assembled ashore. A long hark-forward: The Irish Mail (*centre*), with a Royal Scot class engine, is leaving the bridge, about 1930. Below is the superb Britannia Bridge across the Menai Strait, viewed from the Anglesea side soon after completion.

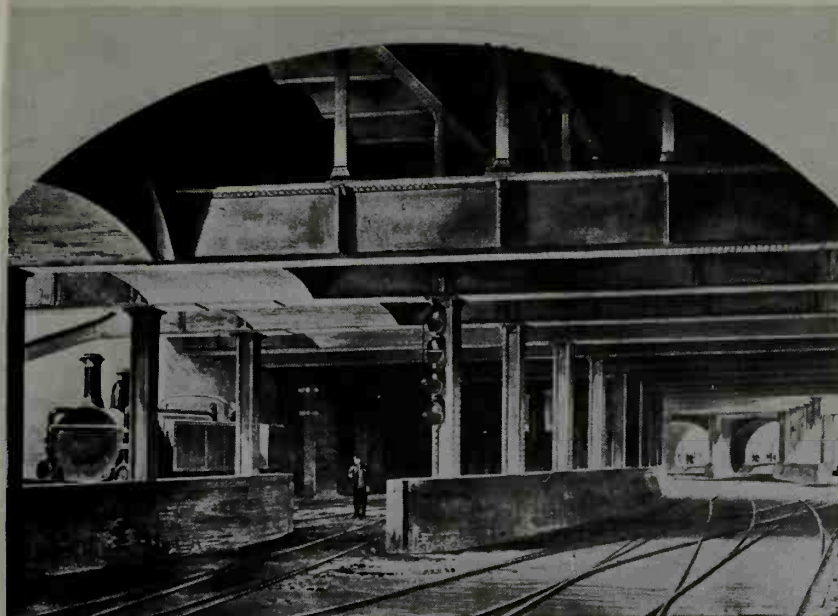




99. Construction: One of the most expensive sections of railway built during the middle years was the South Eastern's extension in London from London Bridge to Cannon Street and Charing Cross. This view shows heavy girders being erected outside London Bridge Station in 1863.



100-1. Cannon Street Station, London, in 1866. The South Eastern Railway had joyously embraced the most grandiose in Victorian styling and, with its neighbour at Charing Cross, the station was greatly admired. It was badly burnt during the bombing in 1941, and one of the spires fell into the forecourt; but war could not break it, nor the fires destroy.



102. Underground: The first section of the world's first city underground railway was opened in 1863—the Metropolitan Railway from Bishop's Road, Paddington, to Farringdon Street. Here are the engine sidings under girder and jack-arch with, in the middle, an early colour-light signal.

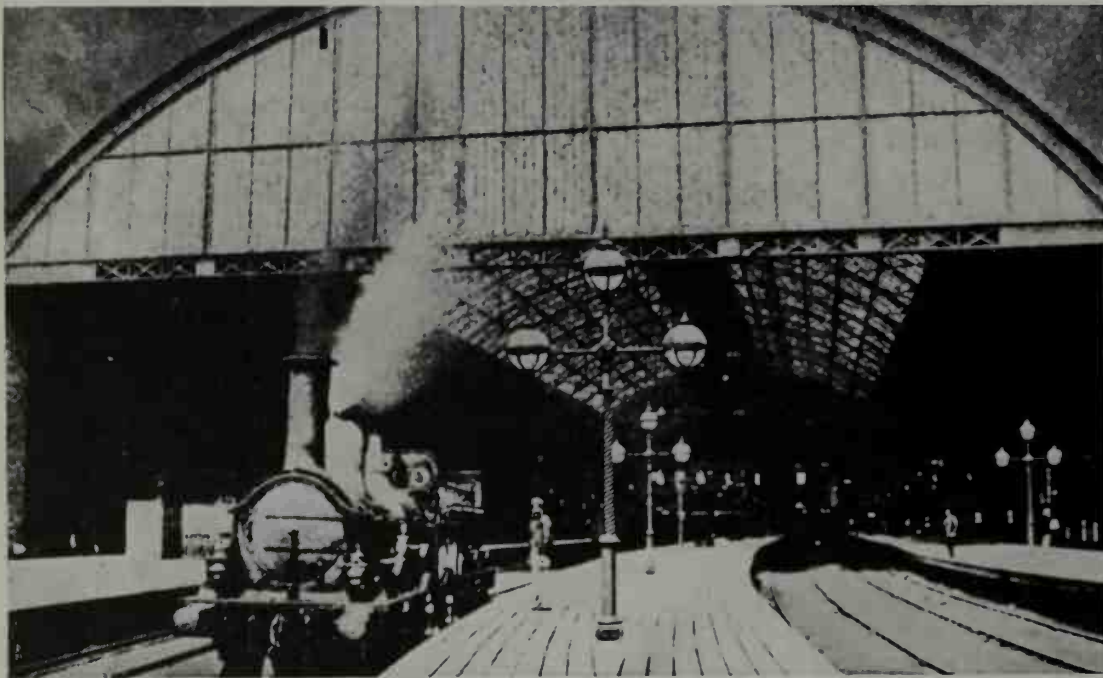


103. Deep level: The Metropolitan Railway was but a year old when experiments were begun with what, in later years, has been called a tube railway. In 1864, at the Crystal Palace, such a line was demonstrated, with the car puffed through the tube like a pellet, under air pressure. It was at least a brave attempt, and the principle was used for conveyance of mailbags by the Pneumatic Dispatch Company.

104. Under two companies, the Underground system spread about the city. This is Blackfriars, District Railway, in 1875. Engines condensed their exhaust, but smoke was allowed to look after itself. In an otherwise admirable drawing, the artist has forgotten the nearer rail of the crossover.

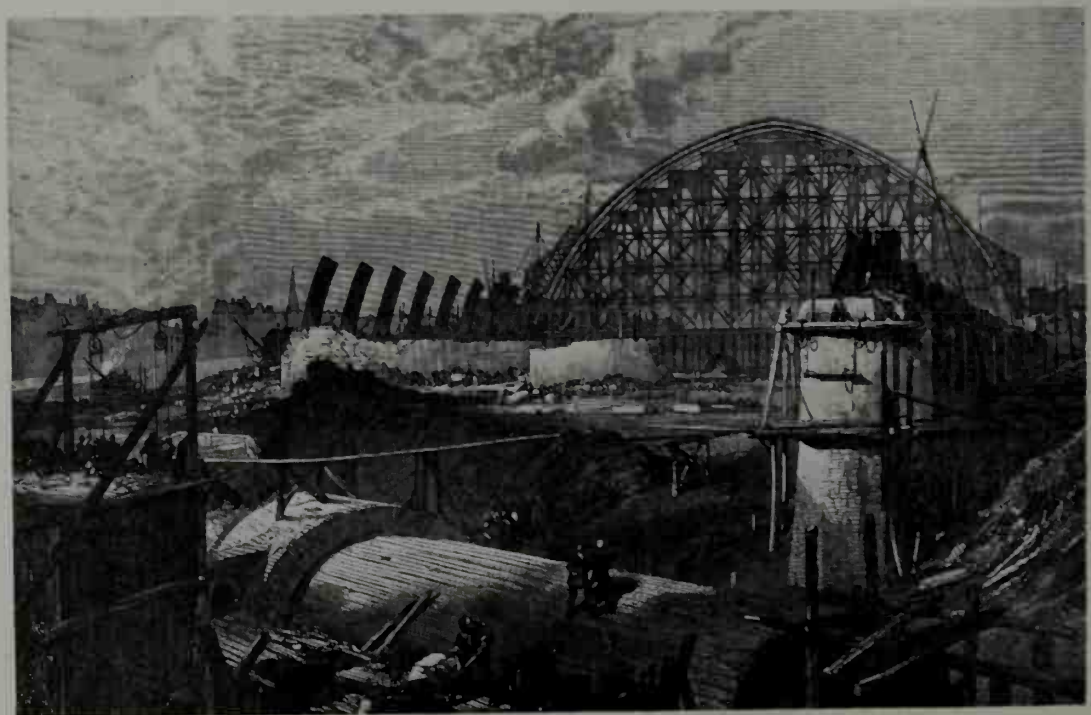


105. London's two Victorias in 1901. Both still without façade, the Chatham station is on the left, with the old Brighton station beyond. The companies were generally good neighbours during the last century, though they ran rival services to the Crystal Palace and to Paris.



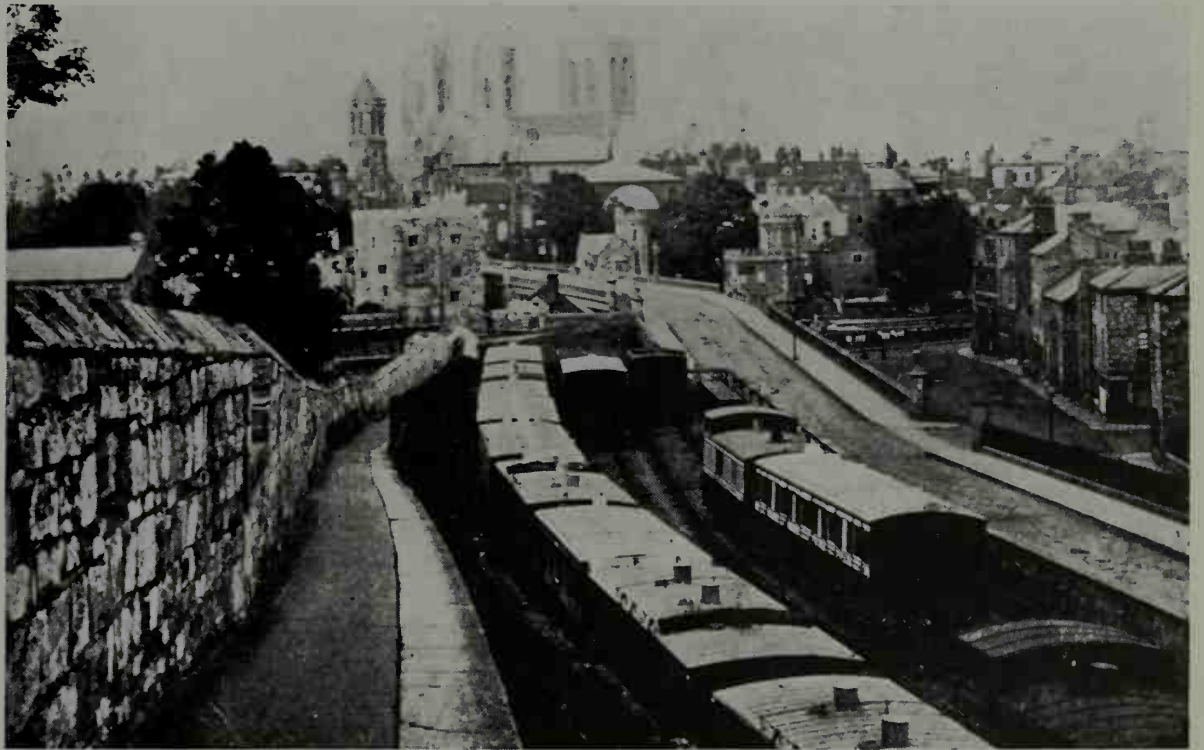
106. Charing Cross Station, London, in the 'sixties, with the handsome roof which fell in 1905. An old Cudworth engine of the South Eastern blows off and waits for something to turn up.

107. In the early 'sixties the Midland Railway, previously a tenant of the Great Northern at King's Cross, began to build its own terminus in London at St. Pancras. In the foreground is the tunnel connection to the Metropolitan Railway.





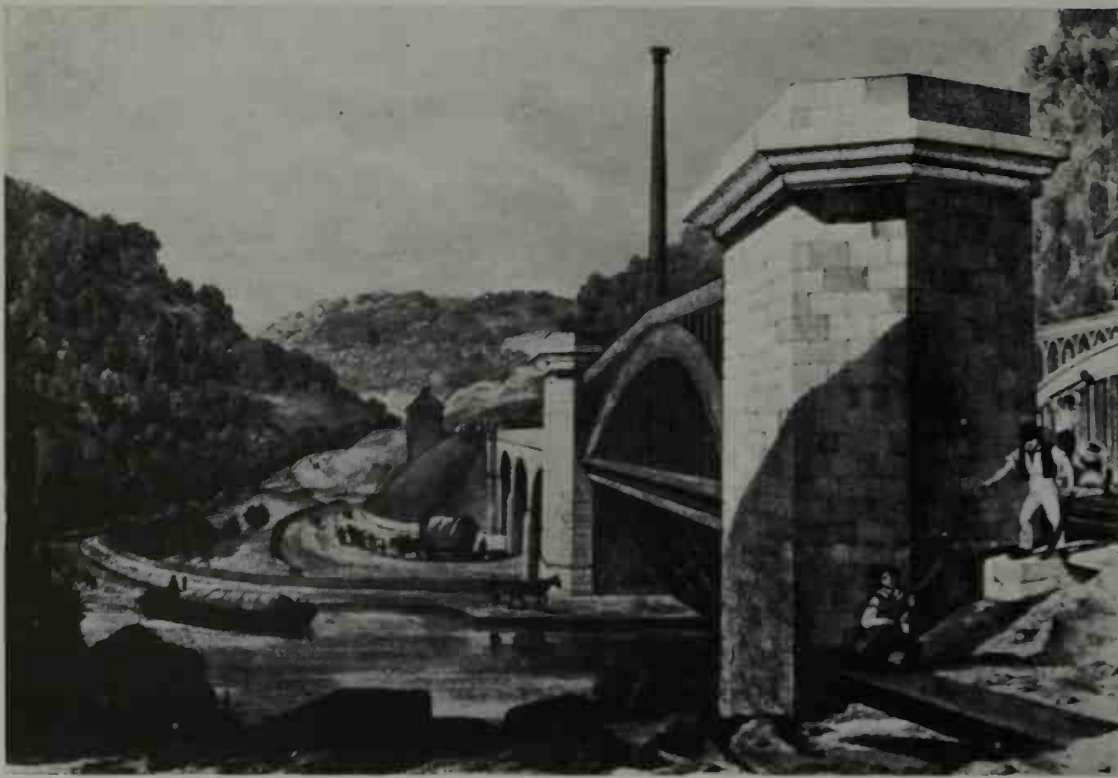
108. Dover Priory, London, Chatham and Dover Railway, in the 'seventies.



109. Under the walls of York in 1858. Most of the carriages have luggage rails and tarpaulins on the roofs (see 17).



110. Carshalton, London, Brighton and South Coast Railway, at the close of the mid-Victorian years. The stationmaster (on left, in top hat) was proud of his roses, his begonias and his rustic seats.



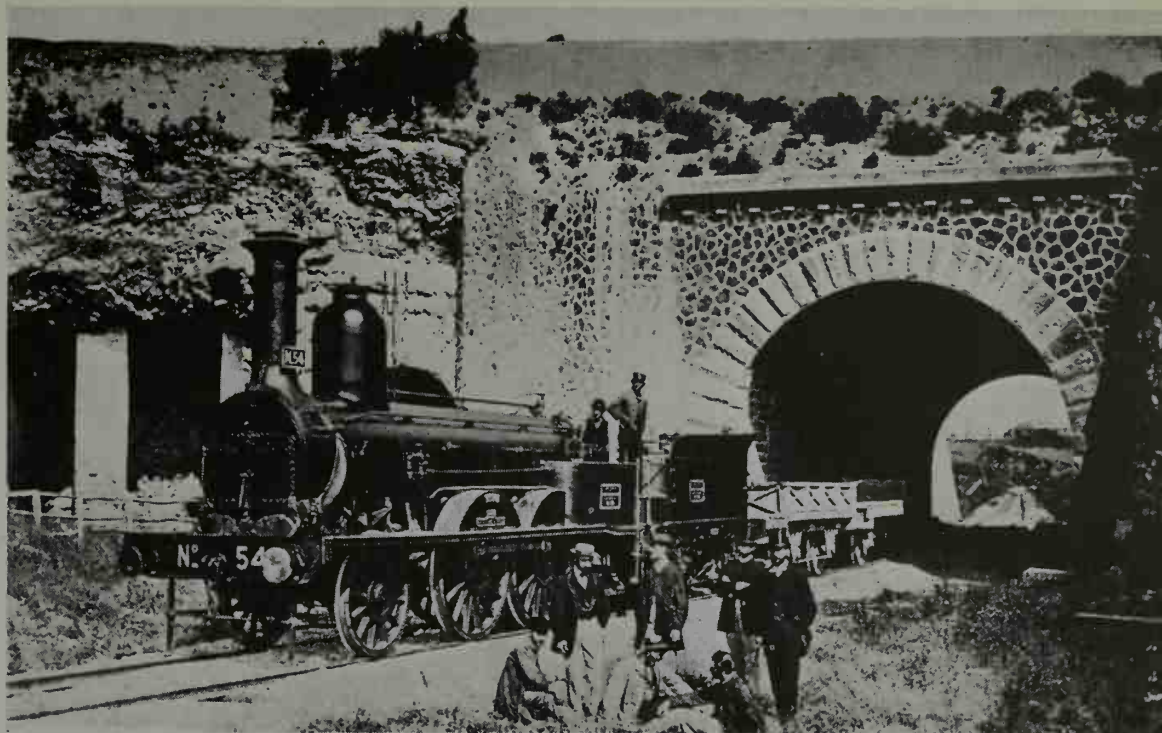
111. An iron bridge on the Manchester and Leeds Railway.

112. Specialised needs of the railway involved building of a new type, without precedent. Here, without further comment, is Frith's *The Railway Station*, which was Paddington.



113. Erecting shop of the Grand Junction Railway at Crewe in 1849, with one of Alexander Allan's locomotives being assembled.

114. Far from industrial England, the railway came diffidently to the Papal States. In this view of 1856, the *Vaticano*, a long-boiler engine of the Rome-Frascati Railway, is posed below the Via Nomentana, Rome.



115. St. Pancras early in the present century. Motor cabs have begun to appear on the rank, but there are still five horse buses on inter-station service, with four-wheelers and hansoms galore.

116. British railways had many might-have-beens. The Manchester and Milford never became more than a local line from Aberystwyth. Here, an ex-London and North Western Crewe goods engine poses beside the station family and staff at Llanybyther.





117-18. American railroads (this sonorous old English word was perpetuated in the States!) were not so much imposed on an existing realm and economy; they made new ones. Where the lines went, new farms and new towns followed. On the rail, the great Union as we know it was founded. There, also, was the first great war to be fought with mechanical transport, and the Northern victory was largely due to superior engineering resources. The upper view shows a train of the United States Military Railroads on a temporary trestle; below is the Federal Army's Bouquet Battery commanding the Baltimore and Ohio Railroad's line to Washington.



119. With the end of the American Civil War, the first transcontinental railway from the Mississippi Basin to the Pacific Coast was built with incredible speed. Here, three locomotives and two cabooses of the Union Pacific Company test Devil's Gate Bridge.



120. From the West, building eastwards, came the Central Pacific Railroad, one of whose bases is shown here. The two lines rushed to meet each other in the deserts of Utah.

121. Promontory Point, Utah, May 10, 1869. C.P.R.R. *Jupiter* on the left; U.P.R.R. No. 119 on the right.

*Said the Union: "Don't reflect or
I'll run over some director!"
Said the Central: "I'm pacific,
But when riled I'm quite terrific.
Yet this day we shall not quarrel;
Just to show these folks this moral:
How two engines, in their vision,
Once have met without collision."*

*That was what the engines said,
Unreported and unread:
Spoken slightly through the nose,
With a whistle at the close.*
(Bret Harte)



122. This stark record of travel in an American day coach by night, in the 'sixties, shows the passengers making the best of the low-backed reversible seats, while the conductor and brakesman go into action against a drunk. The horrors of this sort of journey inspired George M. Pullman's work in the production of superior cars with good sleeping berths.



123. Sunday morning in one of the new Pullman cars on the Union Pacific Railroad, 1869. There may not be a preacher, but there are hymn books, an organ, and an old German to play it. The conductor takes off his cap as he enters the car, an unprecedented act of official humility.



124. Proper sleeping cars appeared in Great Britain in 1873, but the Pullman sleepers imported from America by the Midland Railway, in the following year, were a great improvement on anything existing on British railways at that time. These vignettes were taken from *The Graphic*.



125. Mid-Victorian Canada: A view along the international suspension bridge at Niagara in the 'sixties. It was laid with mixed gauge, and a special light locomotive of the broad-gauge Great Western Railway of Canada took the cars across.



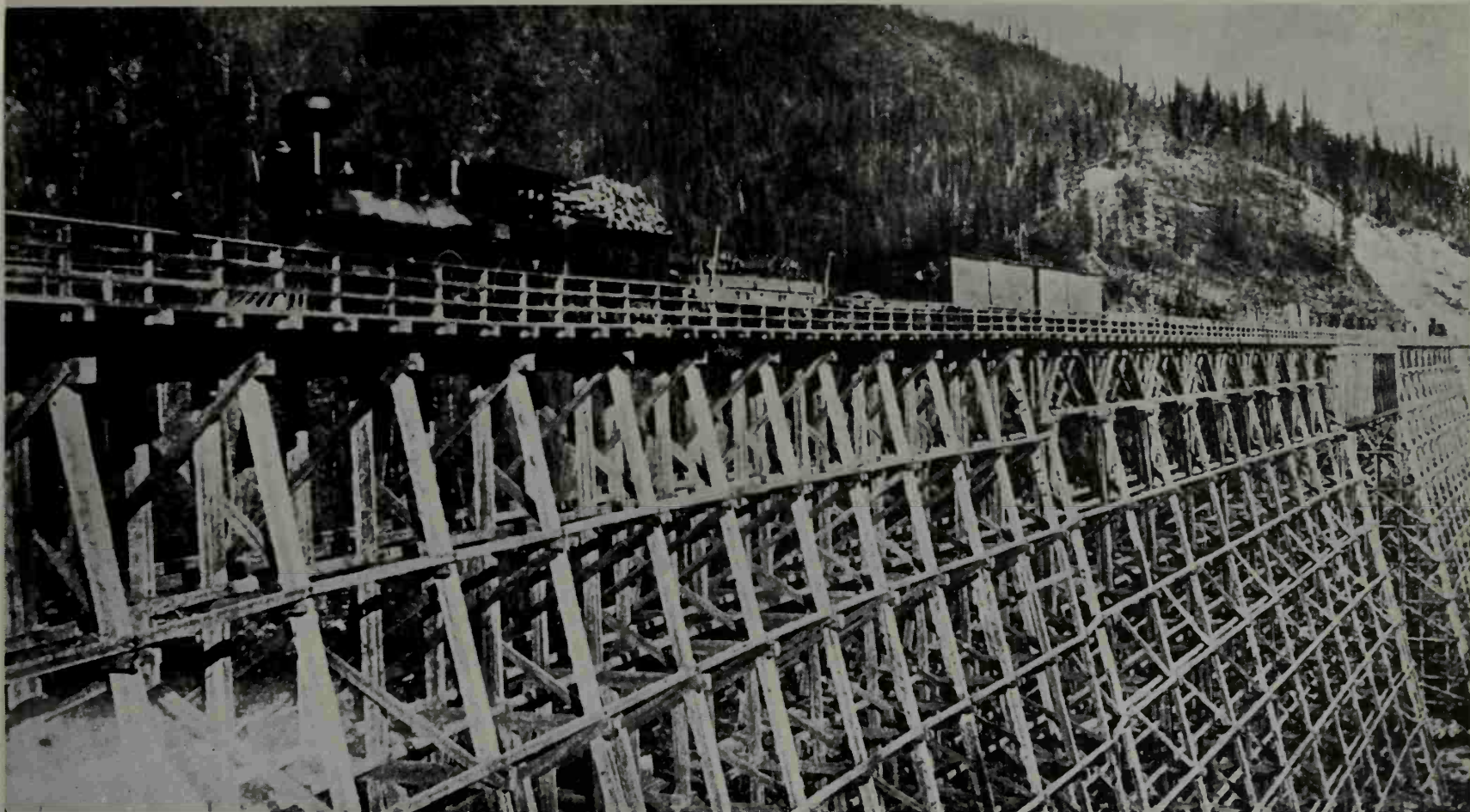
126. Before it patronised Mr. Pullman, the G.W.R. (C.) had its own ideas about sleeping cars, which it ran in the night trains across Ontario. The cars were made as wide as possible, with three tiers of berths on one side of the aisle, and ordinary day-coach seats on the other.



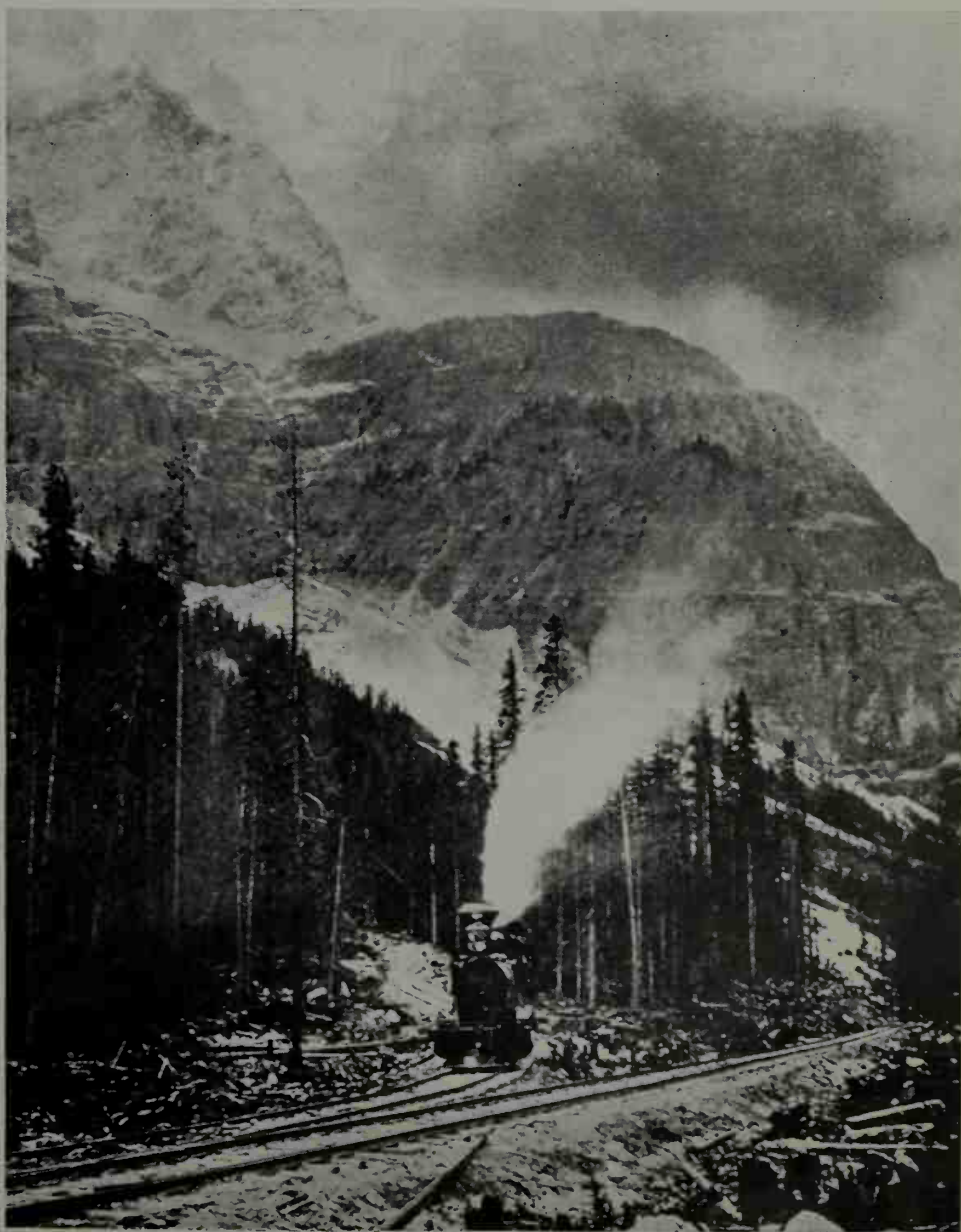
127. Many of the old Canadian locomotives were of British build and type, though later Canada adopted the classic North American engine. *Spitfire*, of the Great Western, was entirely British, though the bogie, stack, and other accessories were later additions.

128. By degrees, even the poor colonist was given a sort of Austerity-Pullman. This was on the Canadian Pacific Railway in 1888. Scots are sitting on the left and Irish on the right. The conductor is on speaking terms with both sides. The drawing is unusually accurate in detail, though the perspective of the seat-ends is bungled.

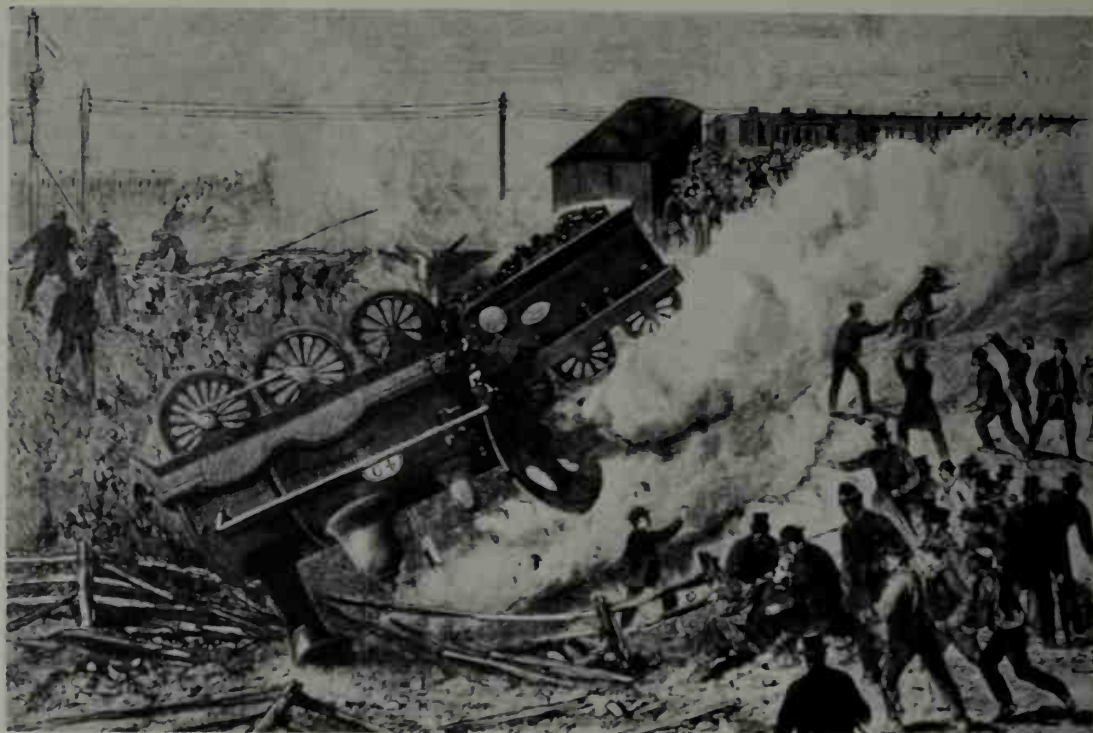




129-30. Completion of the Canadian Pacific Railway on November 7, 1885, did not merely provide the first All-Red Route from Atlantic to Pacific. It probably caused British Columbia to remain in the British Empire instead of being annexed to the United States. These views, taken in 1886, show a siding below Mount Stephen in the Rockies, and (*above*) a characteristic wooden trestle.



131. Accidents to trains varied from the funny-peculiar to the frightful. This old Craven engine, No. 40 of the London, Brighton and South Coast, is not really meant to be standing on her chimney. She went down the embankment near the gypsy encampment at Poupart's Junction, early in 1868.



132. A worst-ever accident was the collision of the Irish Mail with wagons containing petroleum, on the London and North Western Railway at Abergele, on August 20, 1868. Thirty-three were burnt to death.



133. On a November night of 1882 the Pullman sleeping car *Enterprise* caught fire near Hunslet, Leeds, on the Midland Railway. It was never known for certain whether the single fatal casualty, who was drunk, had gone to sleep smoking, or whether his neighbour had neglected a candle-holder. The conductor had already removed one cigar from the victim's mouth and had given him soda-water.



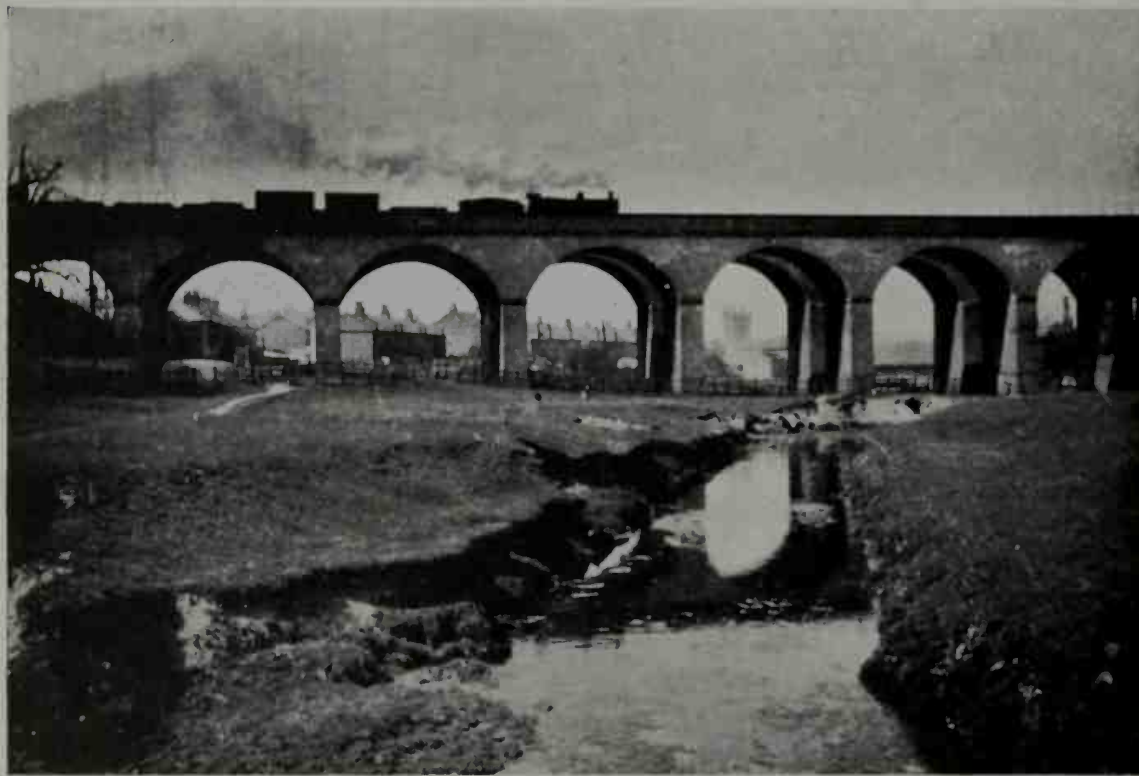


134-5. In the 'seventies, railway progress was marred by some unusually lurid accidents; the Queen and the Press became very restive. At Thorpe, Norwich, on the Great Eastern, in September, 1874, twenty-five were killed by a head-on collision, late on the night of the 10th. Again in 1874, on Christmas Eve, derailment of a decrepit old coach took itself and the rear part of a Great Western express down an embankment at Shipton-on-Cherwell, killing thirty-four.



136. All records of infamy in the British Isles were broken on the night of December 28, 1879, when the first, excessively defective Tay Bridge lost its middle spans in a great gale. With it went the North British Railway's evening mail train from Burntisland to Dundee, with an estimated company of 75-80 persons. There were no survivors.

137. Ruskin raged at the intrusion of the Midland Railway on the Derbyshire dales, 'dragging its close-clinging damnation'. Years after, a photographer looked at the Buxton branch with its handsome red train, and found that they beautifully belonged.



138. Even the commonplace would flower at the touch of the railway. The twin viaducts of the London and North Western invested with a strange grandeur some nondescript meadows, a brook with caving banks, and the eastern outskirts of Wilmslow.

139. Country stationmasters often embellished. Ropley's topiary, on the South Western line from Alton to Winchester, became famous.





140. In the days of non-corridor trains and open stations, the ticket-platform stop often preceded entrance to a city. This is at Perth, with a Highland Railway train from the North. The engine is David Jones's *Strathspey*.



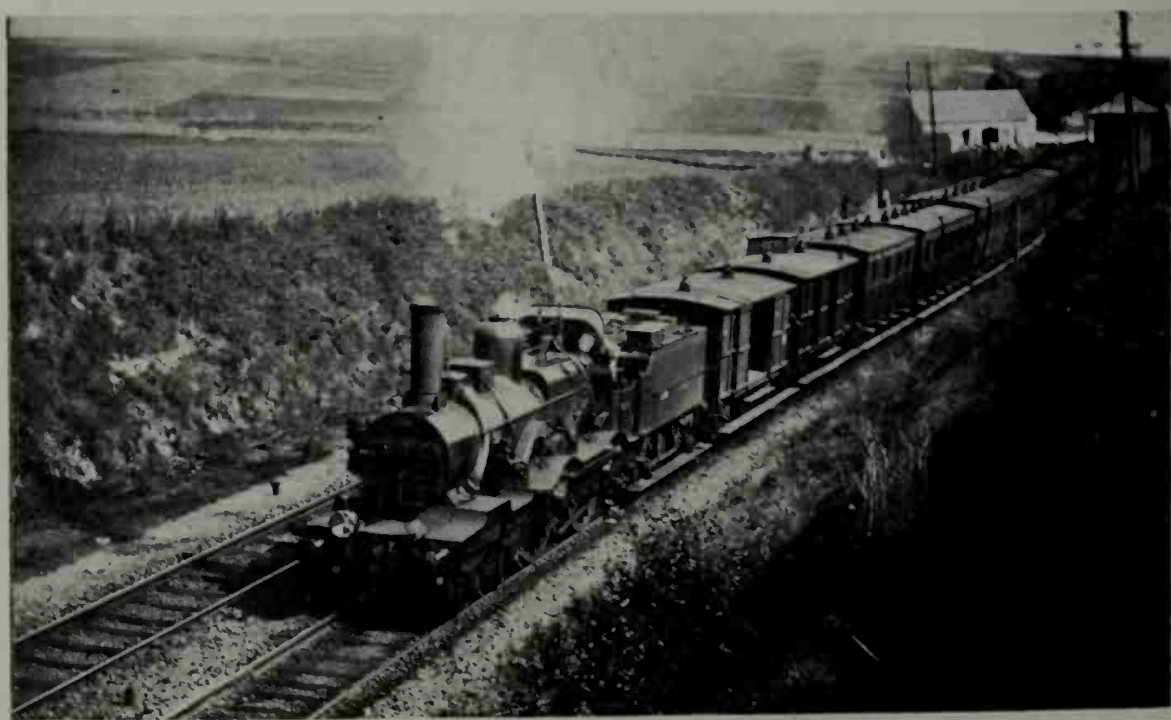
141. On the London and North Western at the end of the Victorian era; a Ramsbottom 'Problem' pilots a Webb 'Teutonic' compound with a Euston-Liverpool express near Weedon.

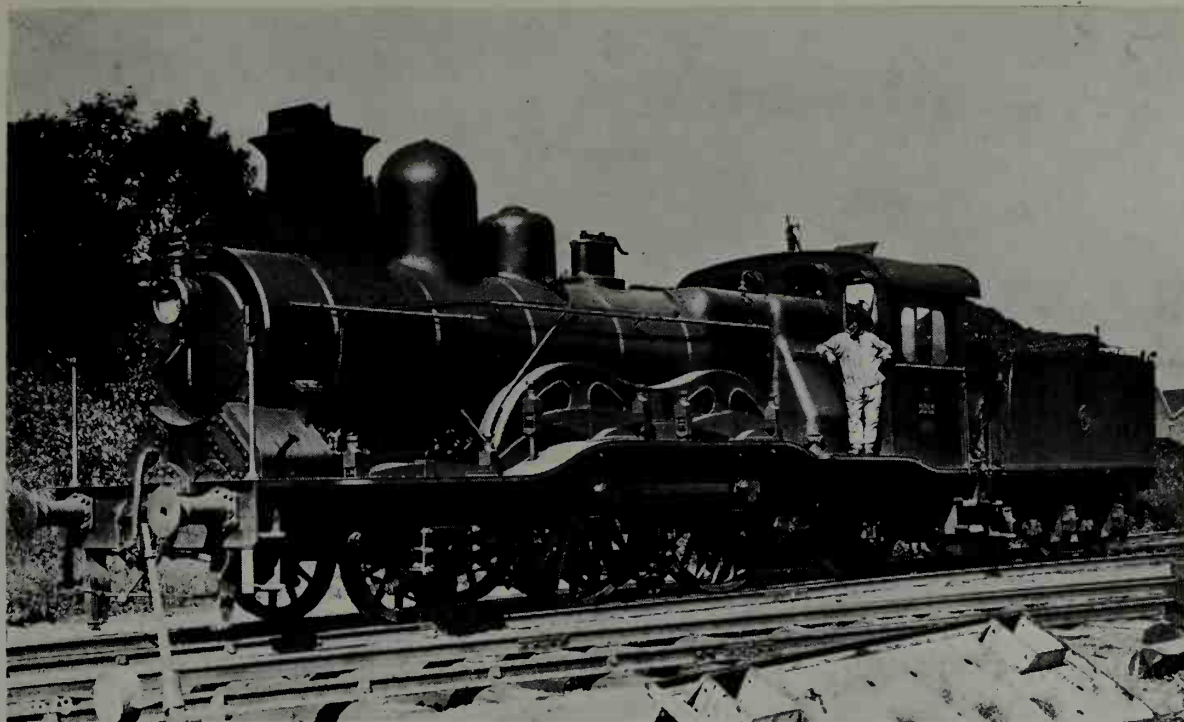


142. Under the arches by Sydney Gardens, Bath. An old sandwich-framed Armstrong express engine of the Great Western brings a choice assortment of oil-lit four-wheelers over the mixed gauge.

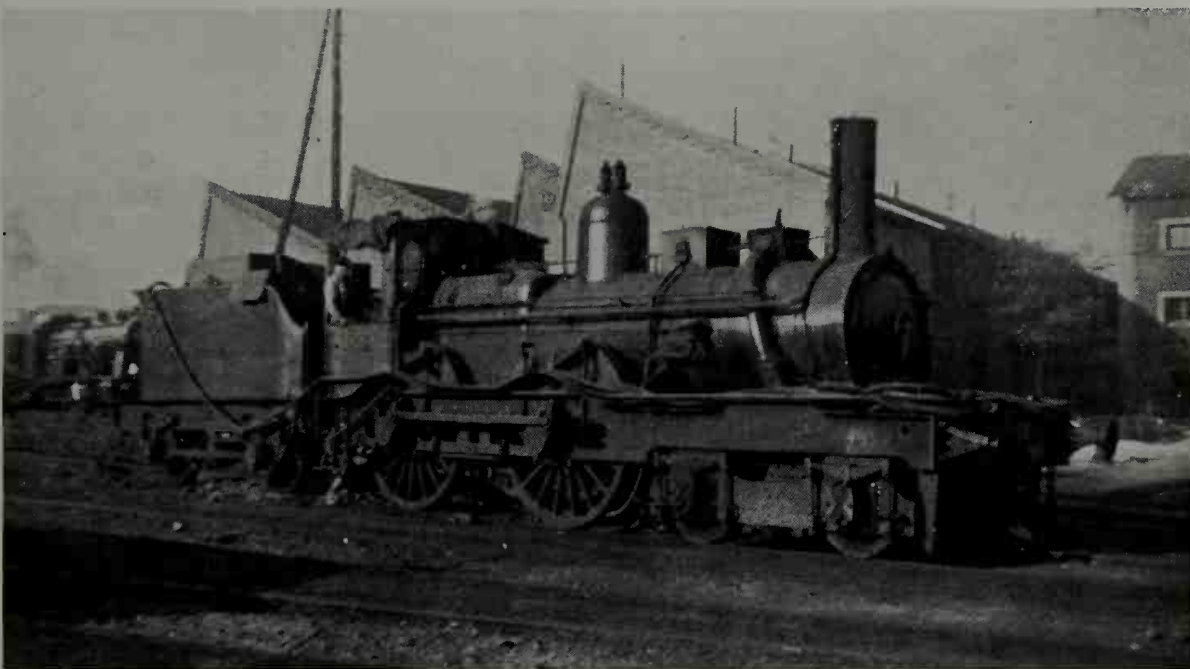


143-5. Nineteenth-century France:
Above is a train on the Eastern
Railway, headed by a Crampton
engine (*Odessa*), piloting a post-
Crampton 2-4-0. In the middle is
an express of the Paris-Orleans
Railway in the 'nineties. The engine,
a particularly fine example of old
French styling, was clothed in
polished brass. Highfliers of the
Northern Railway of France during
the 'eighties were the imposing
Oustrance-class bogie engines, one of
which, in the lower view, is heading
a train through the chalk downs of
the Pas de Calais.

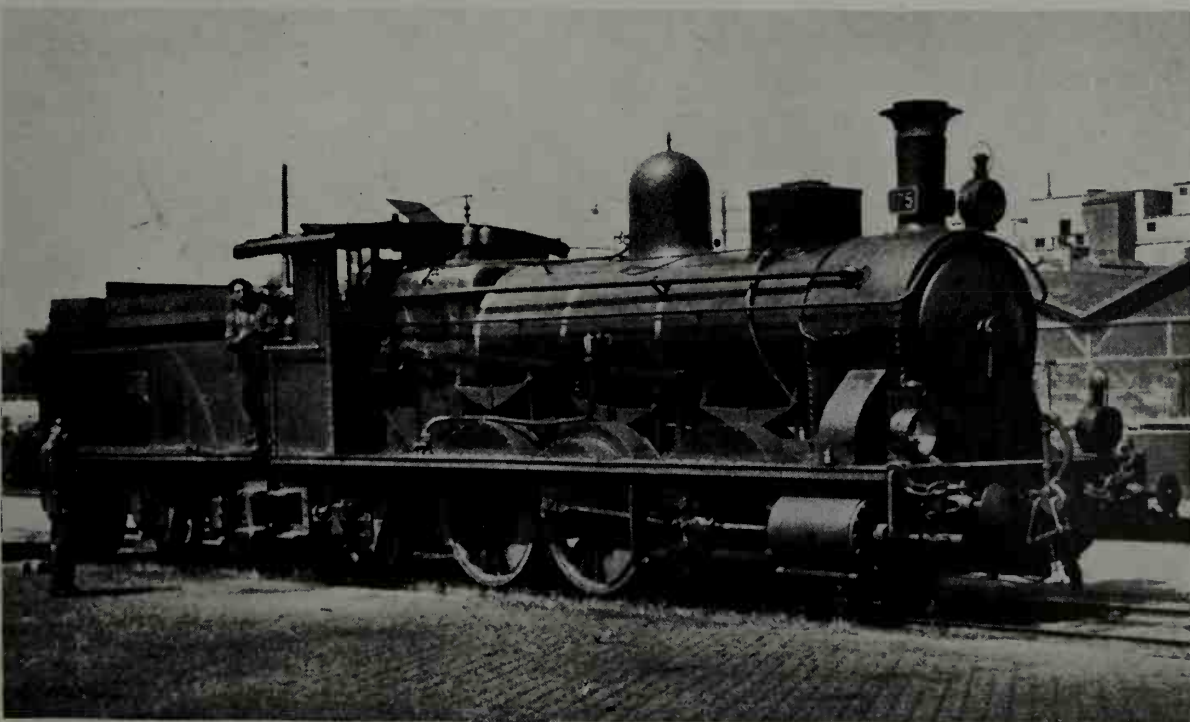




146. Belgium, a country producing among others two such eminent designers in steam as Belpaire and Walschaerts, could be relied on to build locomotives that were different. This, built in the late 'eighties, was a Type 12 express engine of the Belgian State Railways. The square chimney was as inimitably Belgian as Bruges.



147. In Spain, anything was possible, even a baby Outrance on broad gauge. Further, she was built, not in France, but by Hartmann of Chemnitz, in 1881, and the photograph was taken at Madrid Delicias in 1955. She came from the Madrid, Caceres and Portugal Railway.



148. Old Port: British-built goods engine of the former Minho-Douro Railway, Portugal.



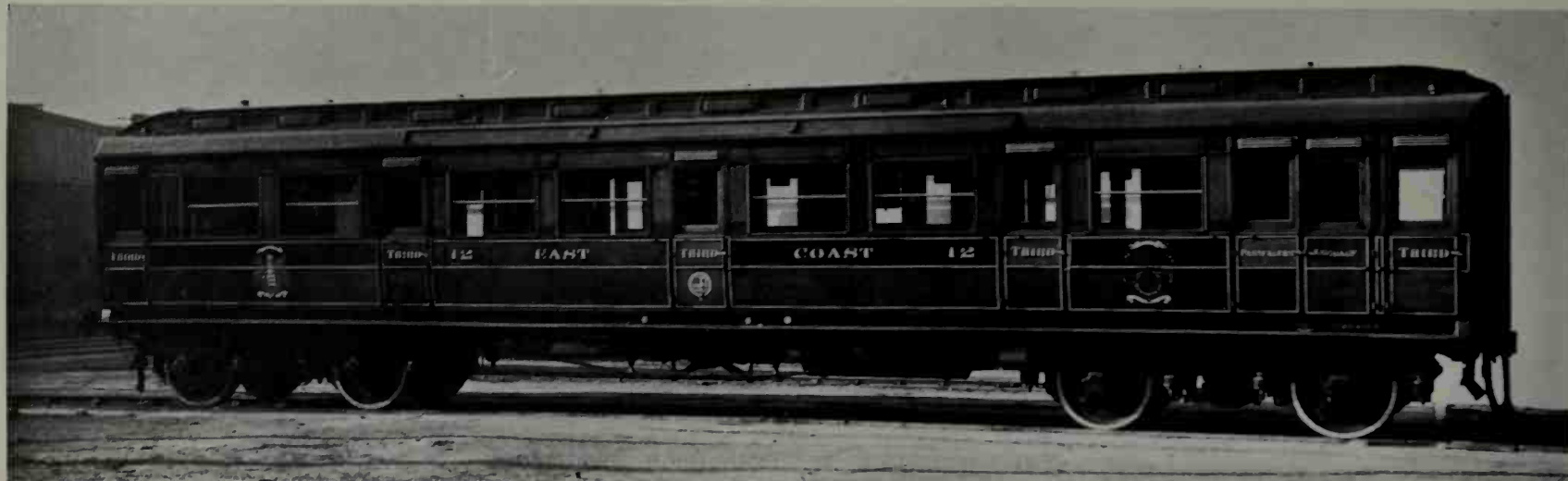
149-51. British railway stations, though not always admirable, have long shown surprising variety. Basingstoke, London and South Western Railway (*above*) exhibited, even in the 'seventies, two variations on the classic theme of platform awnings. The fire-bombs of war could not take away the peculiar dignity of Norwich Thorpe (*centre*). Below is a typical mid-Victorian country station, Gargrave on the Midland, in the 'seventies, with its slotted home signal, archaic lamp-post and platform barrow, and the minatory notice about loiterers, signed by James Allport (see 181).



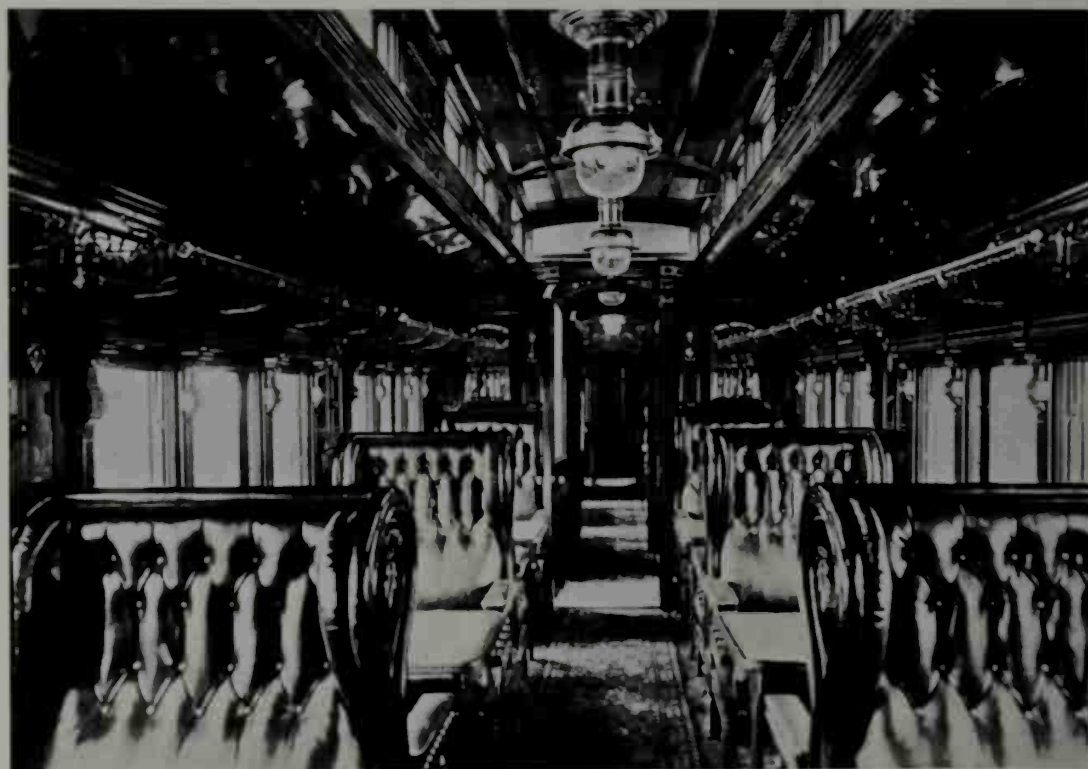


152-4. Accessory features: Stoke belonged to the North Staffordshire Railway; its arms and a locomotive did not come amiss in the windows of the North Stafford Hotel. The old Midland Railway poster is typical of post-Victorian railway publicity. It was removed from Lydney Junction in 1950, twenty-eight years after the passing of the old Midland company. The lamp trolley belonged to every important Victorian station. In the top rack are carriage lamps burning rape oil, and below are rear lamps.





155-7. The clerestory carriage: East Coast Joint Stock third-class corridor coach No. 12, exemplified comfort and elegance on the Scotch expresses, about 1900. It was well upholstered in green plush and lit by compressed oil gas. There were six passenger compartments, two lavatories and a luggage compartment. In the middle is a Midland Railway first-class diner of 1892, the acme of pompous comfort in superior morocco, somehow suggestive of the appointments of the Palace of Westminster. Below is a Great Western family saloon: time of Edward VII. A party, on production of the requisite number of tickets, could travel anywhere in privacy without extra charge. On the table are *Jackanapes* and *The Chaplet of Pearls*. The elder girl has checkmated her brother.





158. In the eighteen-seventies the Midland Railway had caused a revolution (see 181); while abolishing second-class, it gave cushioned seats to the third-class and made a clean sweep of obsolete coaches.



159. Buffet cars, often regarded as a recent thing, are old. This one, more agreeable than some of its successors, was on the London extension of the Great Central Railway at the end of the 'nineties.

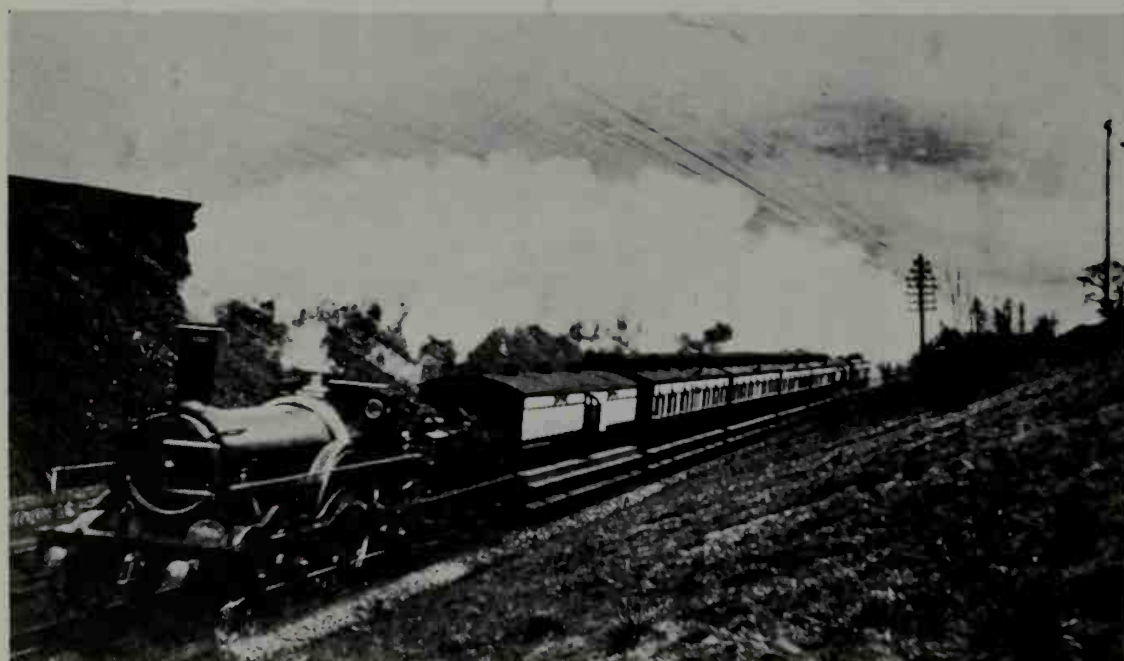


160. A Great Central corridor first-class of 1899. Noteworthy were the semi-elliptical false roof, the generous armrests, and the well-meant but clumsy arrangement of the table across the door on the corridor side.



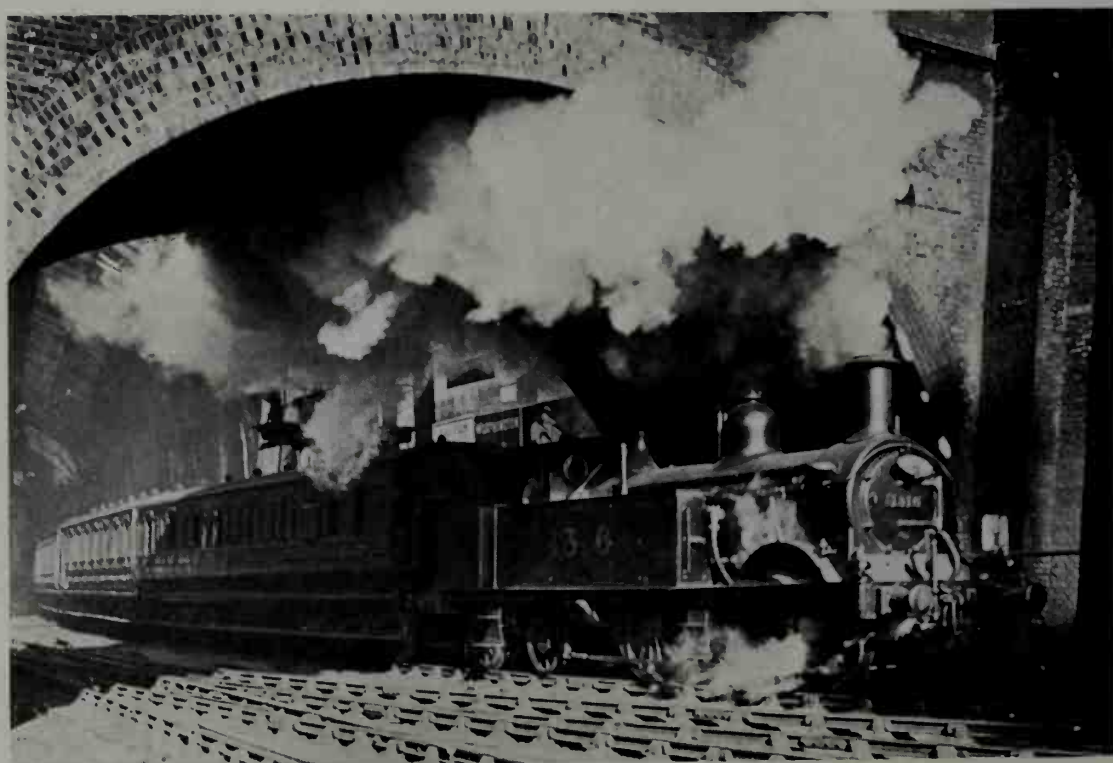
161. Train lavatories ranged from the dreadful to the creditable. This, on the North Eastern in 1911, was excellent of its period, with a pedestal valve closet, flushed by closing the lid.

162. An East Coast express at King's Cross, Great Northern Railway, in the 'eighties. The engine is one of Patrick Stirling's famous eight-foot bogie singles, first built in 1870, and here fitted with an early form of vacuum brake. The second carriage is one of the very rare G.N.R. bogie coaches of the same period.



163. A broad-gauge express of the Great Western, c. 1890. The engine is one of the venerable Iron Duke class, the original design of which dated back to the late eighteen-forties. The coaches are eight-wheelers, 10 ft. 6 in. wide. The vans have narrow bodies with wide duckets.

164. From the beginning, there was main-line access to the Metropolitan Railway. Here, a Midland suburban train from Moorgate to East Ham goes fuming through the Metropolitan widened lines at Aldersgate.





165. A Midland express pulls out of Gloucester, headed by one of Samuel Johnson's lovely bogie single engines.



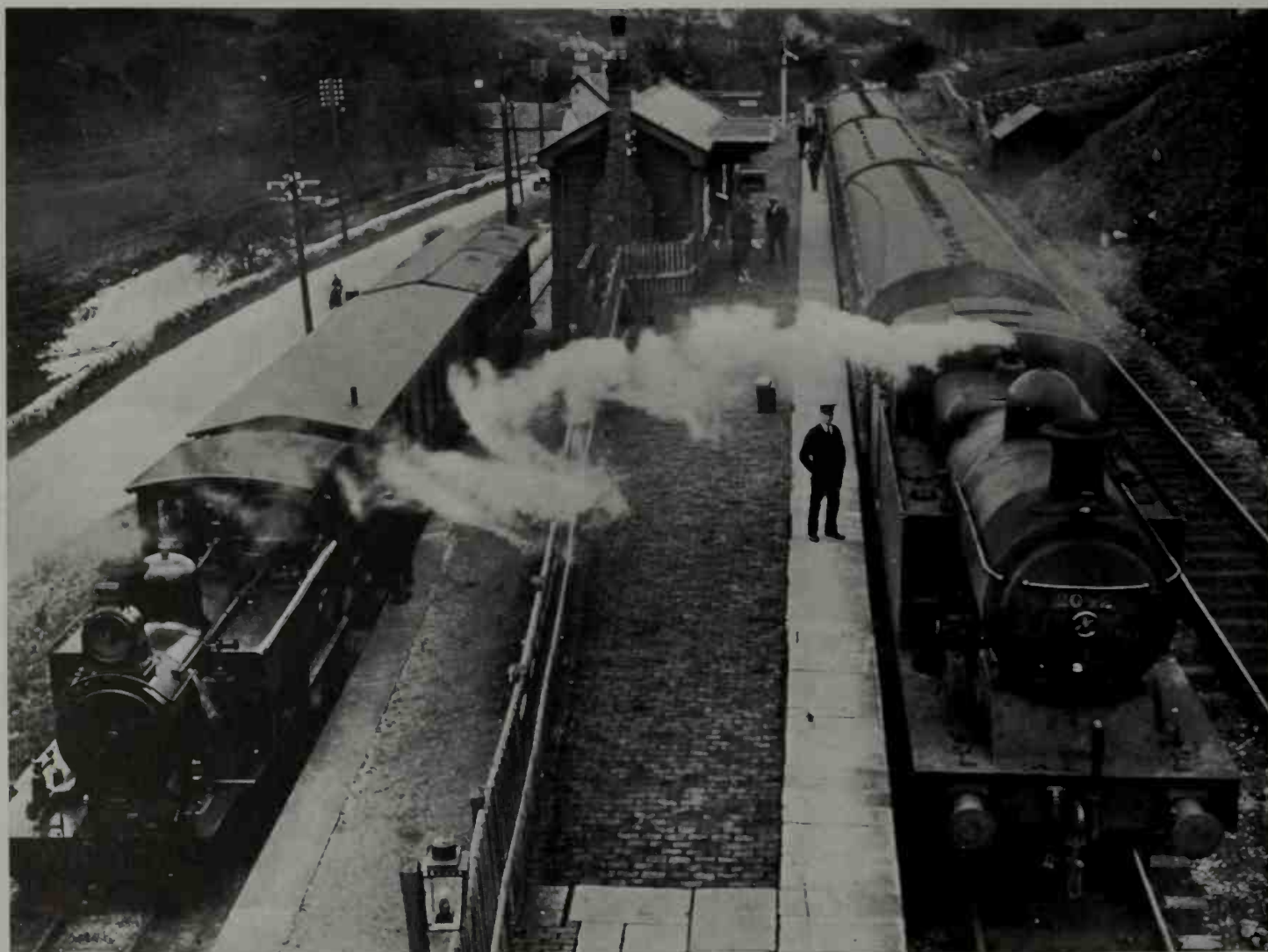
166. Not many passenger services have by-passed London, but a famous example was the Sunny South Special between Manchester and Brighton. Here the train is passing Balham Intermediate Signalbox in the early nineteen-hundreds, headed by the London, Brighton and South Coast engine *Bessemer*.



167. In smoky splendour, one of Francis Webb's three-cylinder compounds of the John Hick class shouts out her heart with a London and North Western train.



168-9. Narrow-gauge: Britain's oldest public narrow-gauge railway (1 ft. 11½ in.), between Portmadoc and Blaenau ffestiniog, was opened in 1836, and was worked by horses and gravity until 1863. The left view shows trains crossing at Tan-y-bwlch in the 'seventies, with a double Fairlie locomotive (*James Spooner*) on the left. On the right is a summer idyll on the Tal-y-llyn Railway (1865) with a disputant—a lady.

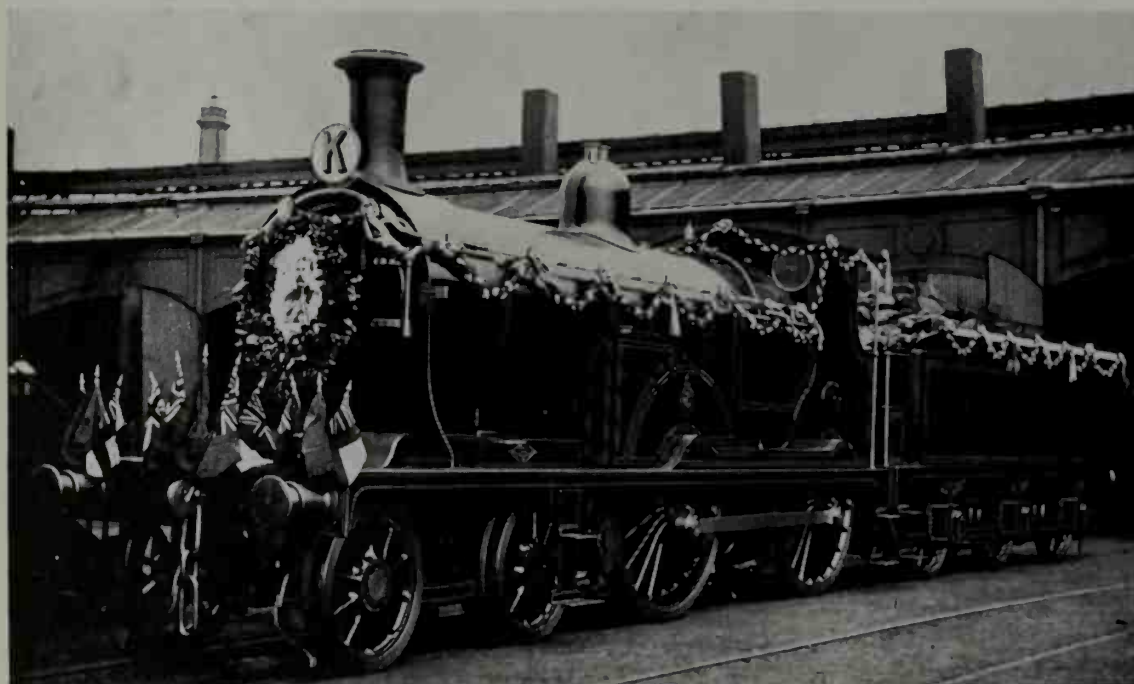


170. Two gauges: Waterhouses on the former North Staffordshire system, L.M.S.R., in 1933. Left is the Manifold Valley narrow-gauge train from Hulme End (engine *J. B. Earle*) and on the standard gauge line is the branch train to Leek, with an ex-North Stafford 0-6-2 tank engine.



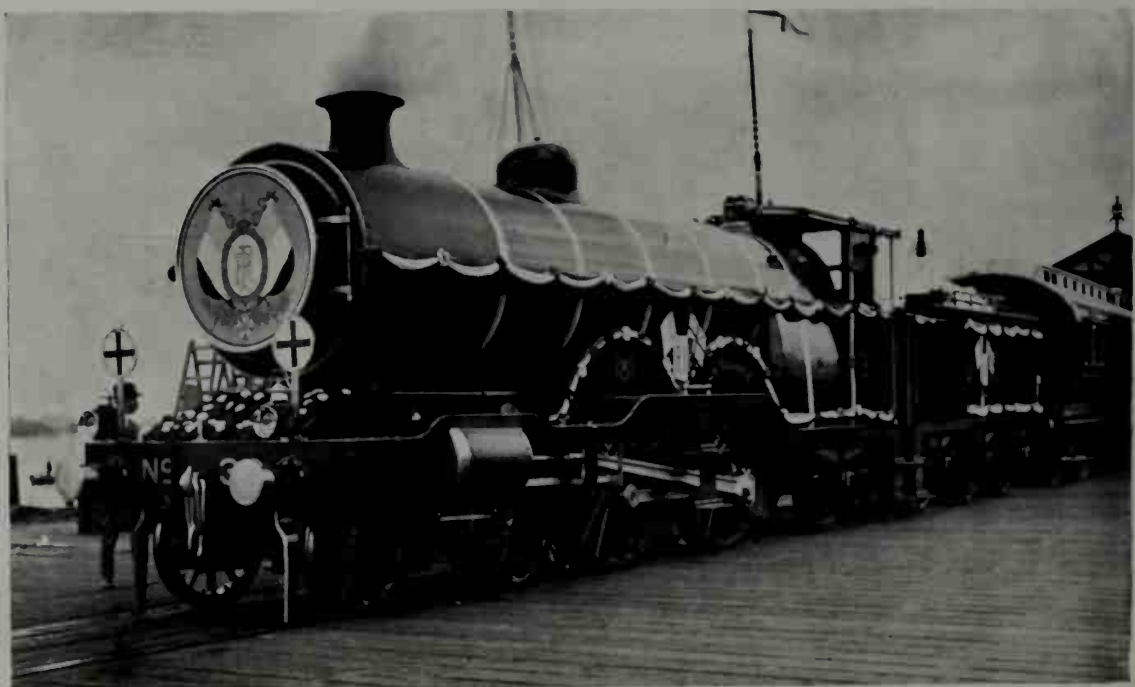
171-3. The Railway Tram: Between Burton-on-Trent and Ashby-de-la-Zouch, the Midland Railway's electric cars adventured across the quiet meadows until the motor did for them in 1927. Much longer, between Grimsby and Immingham, ran the cars introduced by the Great Central Railway. Right is one of the neat single-deck composite cars which the Great North of Scotland put on to serve its Cruden Bay Hotel in 1899. They worked until 1940, and their last job was to carry the laundry baskets.

174. Decorations were worn. This old Sturrock engine of the Great Northern had been dressed for the Hitchin Engineers' Department annual outing (middle 'eighties). The E.D. appropriated the Royal Arms, but nobody seems to have minded.



175. Having, after some initial difficulty, won a considerable war in South Africa, Britain wasted no apologies on self-righteous critics, but decorated the trains of the homecoming victors. London and South Western No. 773, one of the real beauties of late Victorian practice, was Kitchener's engine from Southampton.

176. Portsmouth Harbour, June 24, 1913. *La France* of the London, Brighton and South Coast Railway, adorned for conveying the French President on a State visit. The coal was whitewashed.





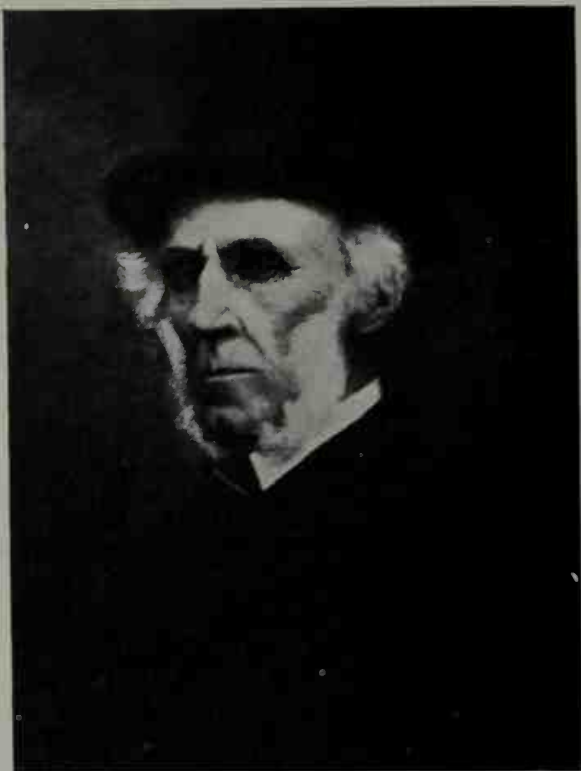
177. Royal train, Great Western Railway. The engine is *The Queen*, and the occasion, Queen Victoria's Diamond Jubilee in 1897.



178. Great Western King's saloon (built in 1897) decorated for the honeymoon journey of Princess Mary and Viscount Lascelles, 1921.



179. G.W.R. royal train at the opening of Avonmouth New Dock, July 9, 1908. The third vehicle is the Queen's Carriage of 1874 (see 95). Employment of a saddle-tank engine was unusual on royal trains.



180-1. Worthies: Sir Richard Moon, chairman of the London and North Western Railway from 1861 to 1891, looks out of the past with a sneer of cold command. On the right, benevolently wily, Sir James Allport, general manager, and later a director, of the Midland, may have been reflecting on an eventful life. Among many things, he gave Pullman cars to the wealthy and soft seats to the third-class.



182. Locomotive and carriage men at Grasmere, June 24, 1892: *Front row* : J. H. Hosgood, Barry Railway; (Sir) John Aspinall, Lancashire and Yorkshire; T. G. Clayton (carriages), Midland Railway; J. C. Park, Great Northern of Ireland; W. Wainwright (carriages), South Eastern; William Dean, Great Western; H. A. Ivatt, Great Southern and Western, Ireland; James Stirling, South Eastern. [*Second row* : T. Hurry Riches, Taff Vale; Bowman Malcolm, Belfast and Northern Counties; J. J. Hanbury, Metropolitan Railway; R. J. Billinton, London, Brighton and South Coast; S. W. Johnson, Midland Railway; William Adams, London and South Western; James Manson, Glasgow and South Western. *Back row* : Hugh McColl; R. Mason, Furness Railway; T. Whitelegg, London, Tilbury and Southend; Matthew Stirling, Hull and Barnsley; J. Parker, Manchester, Sheffield and Lincolnshire; Martin Atcock, Midland Great Western (Ireland); W. Kirtley, London, Chatham and Dover; F. Attock (carriages), Lancashire and Yorkshire.



183. Uniformed staff: A Lancashire and Yorkshire Railway platform group in the 'nineties. The junior porter, with barrow, wears a stiff collar and a bow. Some of the elder porters sit down while passengers stand—but this was indeed The Station Group.



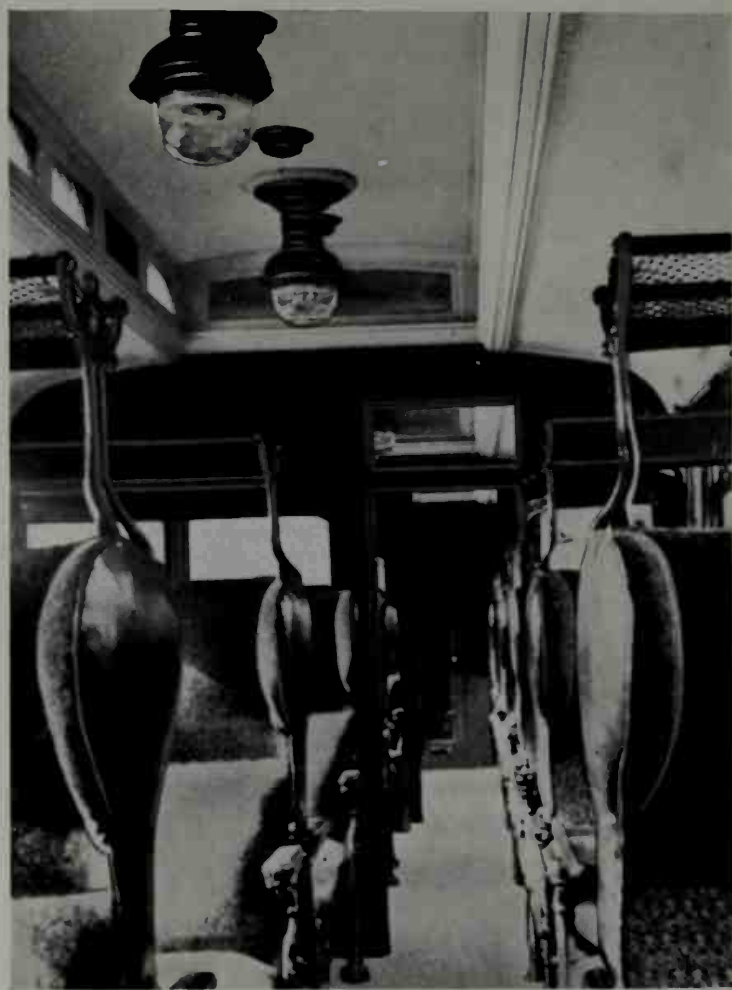
184. London and North Western Railway guard, c. 1850. He still wears a Regency stock. The vaguely naval appearance of London and North Western uniformed grades is supposed to have been due to the background of Admiral Moorsom, a director, and chairman in 1861.



185. On the Great Central in the early nineteen hundreds there was something strangely Prussian about the passenger guards.



186. Country station group on the Midland Railway in the early twentieth century. The bearded driver's bowler hat not only indicated the dignity of the senior skilled mechanic, it had the safeguards of a crash-helmet. On the South Eastern Railway, too, for many years the bowler was invariable driving headgear.



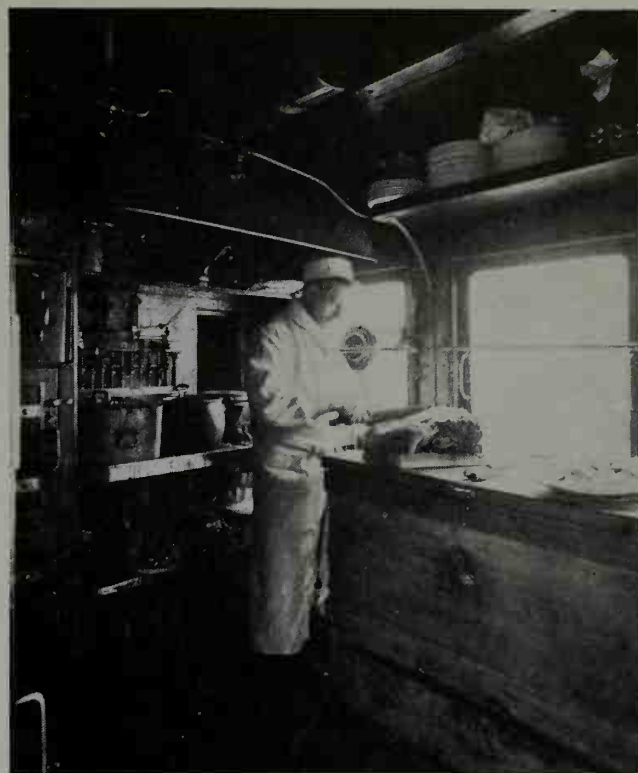
187-8. Two third-class interiors of the early nineteen hundreds: Great Central (*left*) and Great Northern. The former was quite elaborately decorated; the latter had padded section ends to save people's elbows in passage. The gas pendants shed a generous glare from the clerestory.



189-90. Parlour and smoker of the Pullman car *Princess Patricia*, prefabricated in America in 1905 and used on the Brighton Limited. In this, and in the Great Central carriage, the electric lamp glasses show an unconscious preoccupation with Victorian trouserines.



191-2. Amenities, early twentieth-century. On the left is a West Coast single-berth sleeper. It is not in imminent danger of collision; the Caledonian engine outside is standing on the sharply curved Dundee line at Perth. On the right, a London and North Western cook swelters among his joints of beef.



193. In 1908, Davidson Dalziel having bought up the British Pullman Car Company, the Southern Belle was put on between Victoria and Brighton, with all-British cars. This is one of Fortunino Matania's illustrations to the original commemorative booklet. He painted several, in sumptuous oils.



194. Shortly before the outbreak of the 1914-18 war the unique glass-ended Pullman observation car, *Maid of Morven*, was built for the Glasgow-Oban service of the Caledonian Railway.

195. From beginnings in Germany during 1879-81, the electric railway came to England with Magnus Volk's line in Brighton, the first section of which was opened in 1883.



196. This view of Volk's line, taken about 1910, shows the viaduct on the later extension from Paston Place to Black Rock, now filled in. The designer of the old postcard reproduced here has somewhat enhanced the effect of the heavy seas running. Under such conditions working would have been suspended.

197. Opened just after Volk's Brighton line, the Portrush, Giant's Causeway and Bush Valley Tramway in Ireland was the first line in the world to run on hydro-electric power. For many years, steam helped.





198. Briefly at the end of last century, Volk's Electric Railway in Brighton ran a line on the beach itself, between the tidemarks, from the Banjo Groyne to Rottingdean. The car ran on parallel tracks and was served by two wires like the trolleybus of later years. Like a ship, it carried a lifeboat.

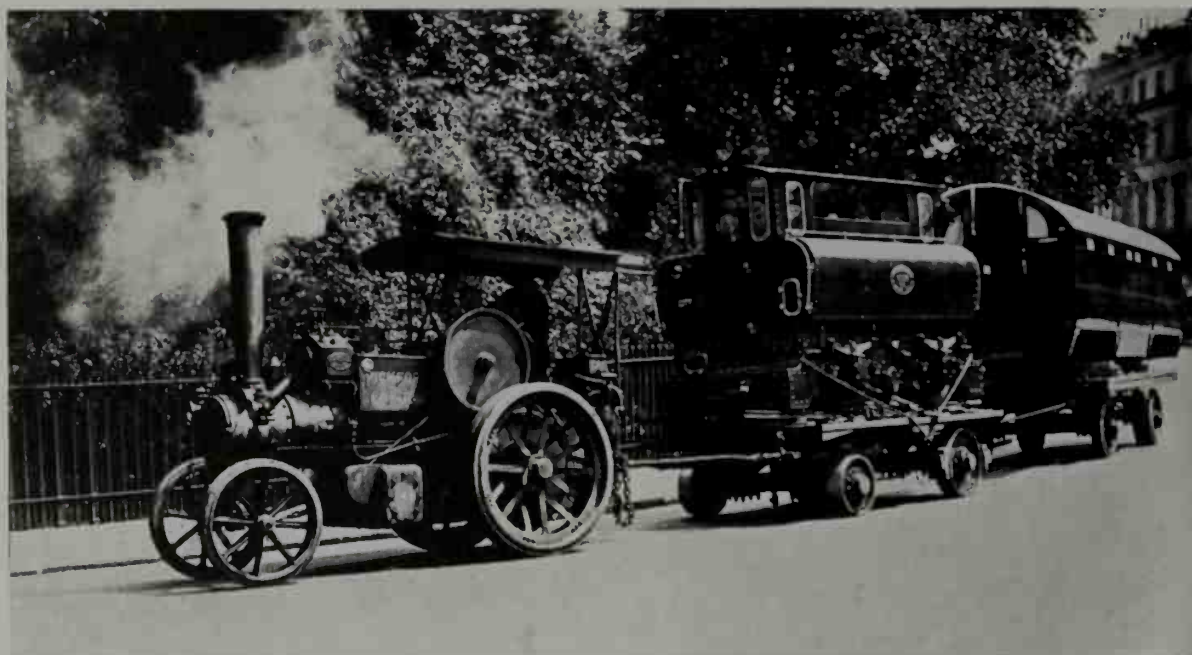


199. The saloon of Volk's Daddy-Longlegs, full of plush and coloured glass, contained Brighton's finest collection of parlour-flora.



200. Storm and tempest wrecked Daddy-Longlegs before long, but it had its poor relations. That at St. Malo in Brittany, with cable haulage, survived for many years.

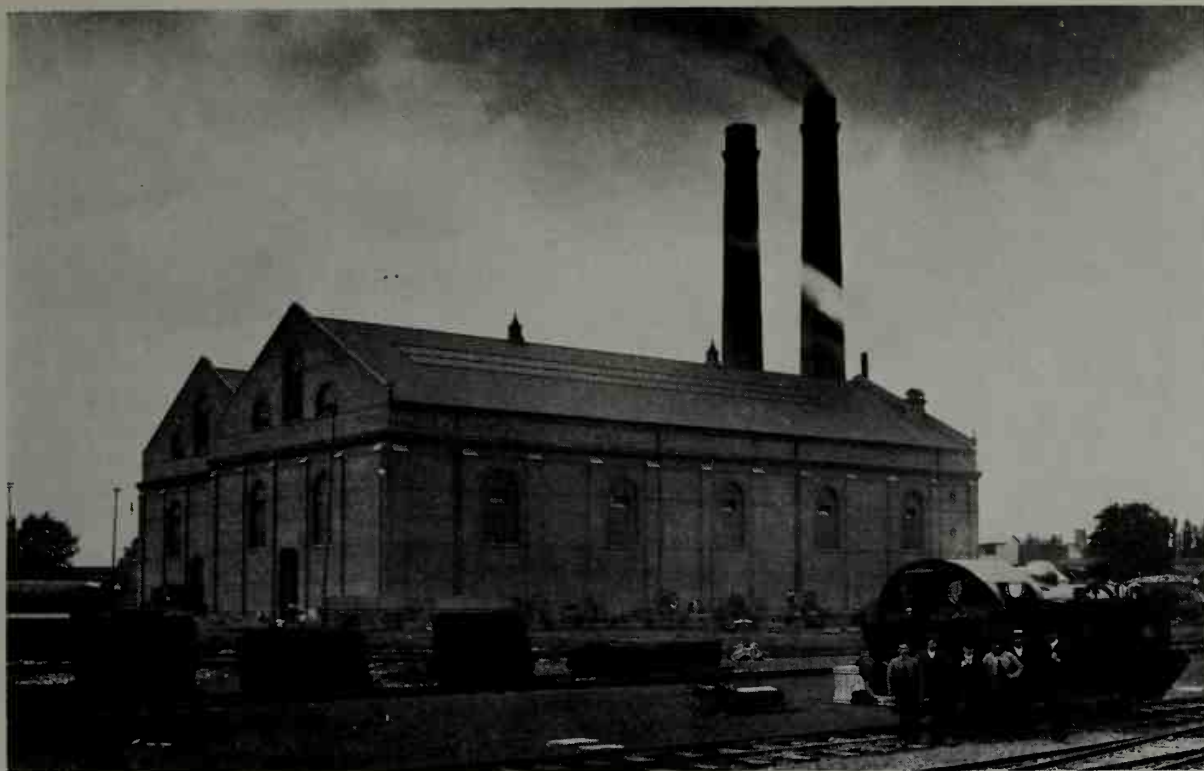
201. In 1890 came the world's first deep-level electric underground railway, the City and South London between Stockwell and King William Street. Small electric locomotives hauled three-car trains of forbidding-looking rolling stock, practically windowless and called 'padded cells' by the public.



202. The City and South London, already much extended, was rebuilt as a more adequate tube line in the early nineteen-twenties. In this scene, locomotive No. 36 and one of the original 'padded-cell' cars were on their way, behind a Pickford's traction engine, to Marylebone Station, whence they were taken to Darlington for the railway (Stockton and Darlington) centenary celebrations of 1925.

203. On an altogether larger scale was the Central London Railway, opened in 1900. Handsome cars were hauled, at first, by quite massive 40-ton electric locomotives. Owing to excessive vibration, these were soon replaced by motor cars working in multiple unit, and thus were worked all subsequent tube lines in what became a vast network under London.





204. Wood Lane Power Station, Central London Railway, early in the present century. In the foreground is one of the two condensing steam locomotives (*condensed* would be equally appropriate!) used for many years for working ballast trains and empty stock.

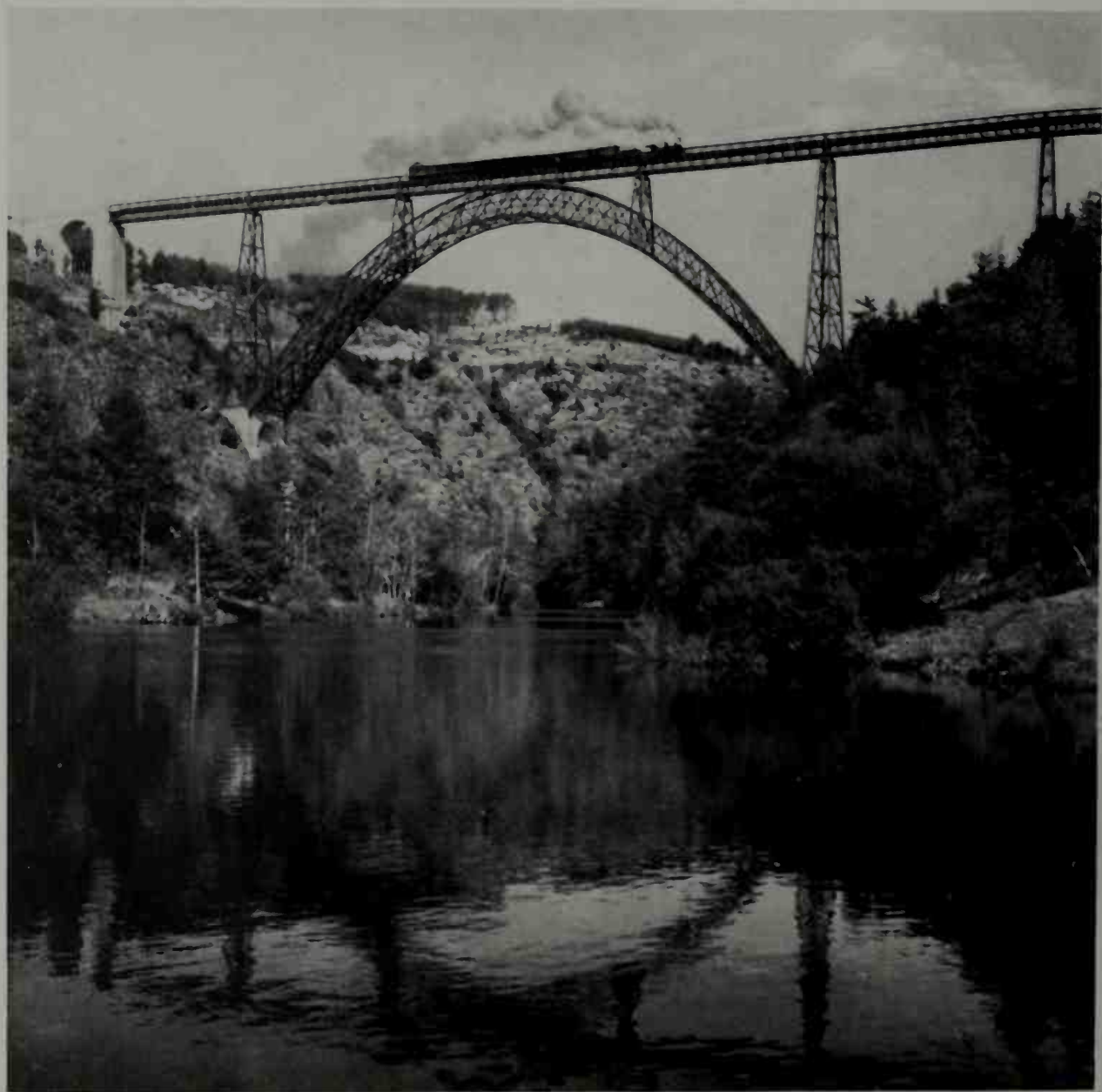
205-6. Not until 1905 were the Metropolitan and District lines fully electrified. Multiple-unit trains were used from the first, but electric locomotives were used for trains originating or terminating beyond the electric network. The upper view shows a pair of District locomotives or motor vans heading a train of London and North Western coaches outside Lillie Bridge depot. What they were doing there was none of the North Western's business. This was the normal make-up of an Outer Circle train (Broad Street to Mansion House via Willesden, Kensington and Earls Court) in the early days of electric working.

The Metropolitan Railway perpetuated side-door compartment-type coaches for outer suburban traffic. In the lower view a train is disgorging spectators of the 1923 cup final at Wembley Park.

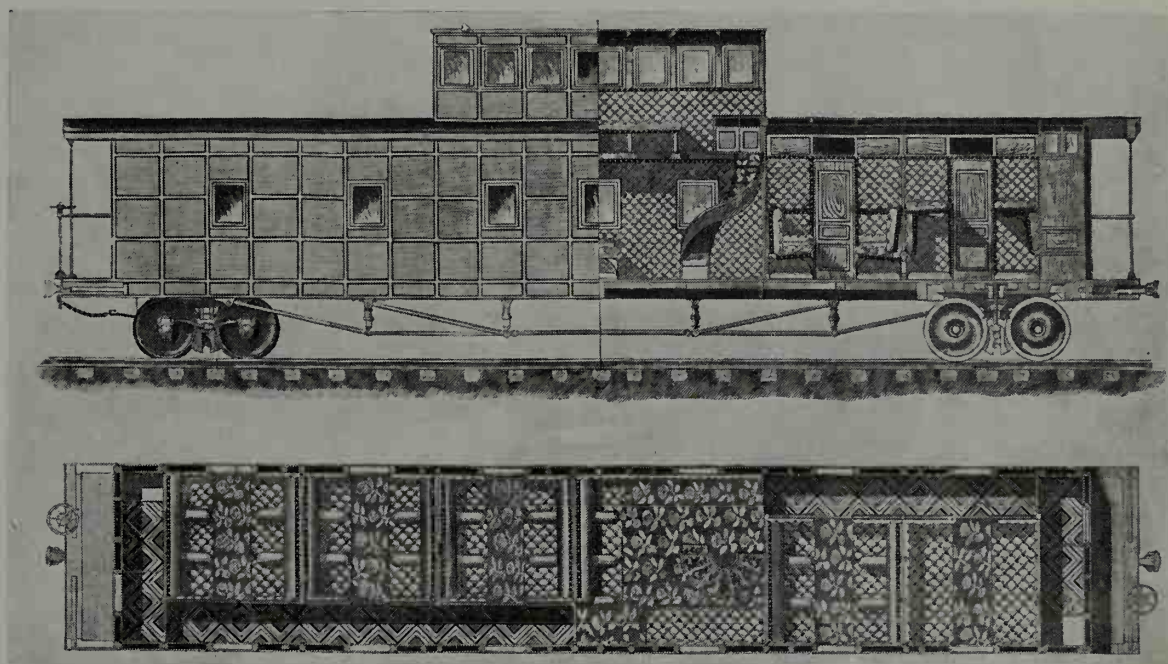
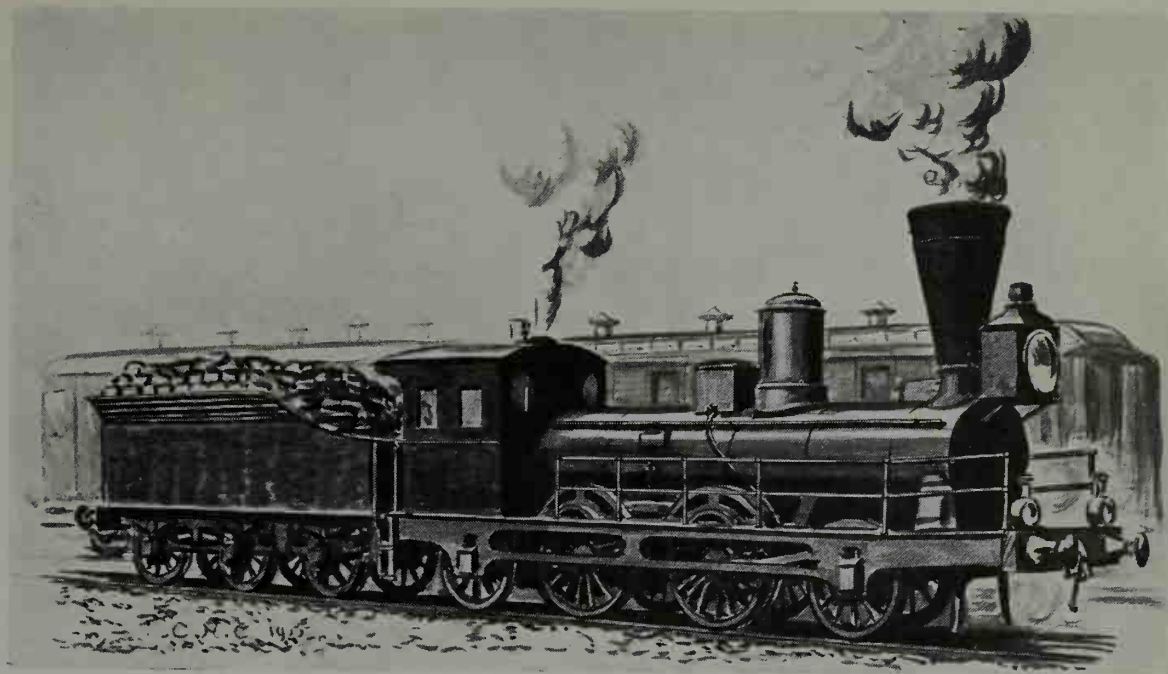




207-8. Above is the superb viaduct of the Provence Railways metre-gauge line at Le Loup. It fell to the Maquis during the nineteen-forties. Right is Eiffel's Garabit viaduct on the Arvant-Begiers line, with a span of 541 ft. 4 in. and a height of 400 ft. above the river.



209. Imperial Government and foreign contractor built lines across the vast Russian plains. In designing locomotives for them, speed was no object, but ability to get plenty of steam out of wood fuel was so. This engine was built by the Alexandrovsky Works in 1871.



210. Few things are really new. This Russian sleeping car, built by the Alexandrovsky Works in 1867, had an upstairs section anticipating the 'vista-dome' of present American practice.



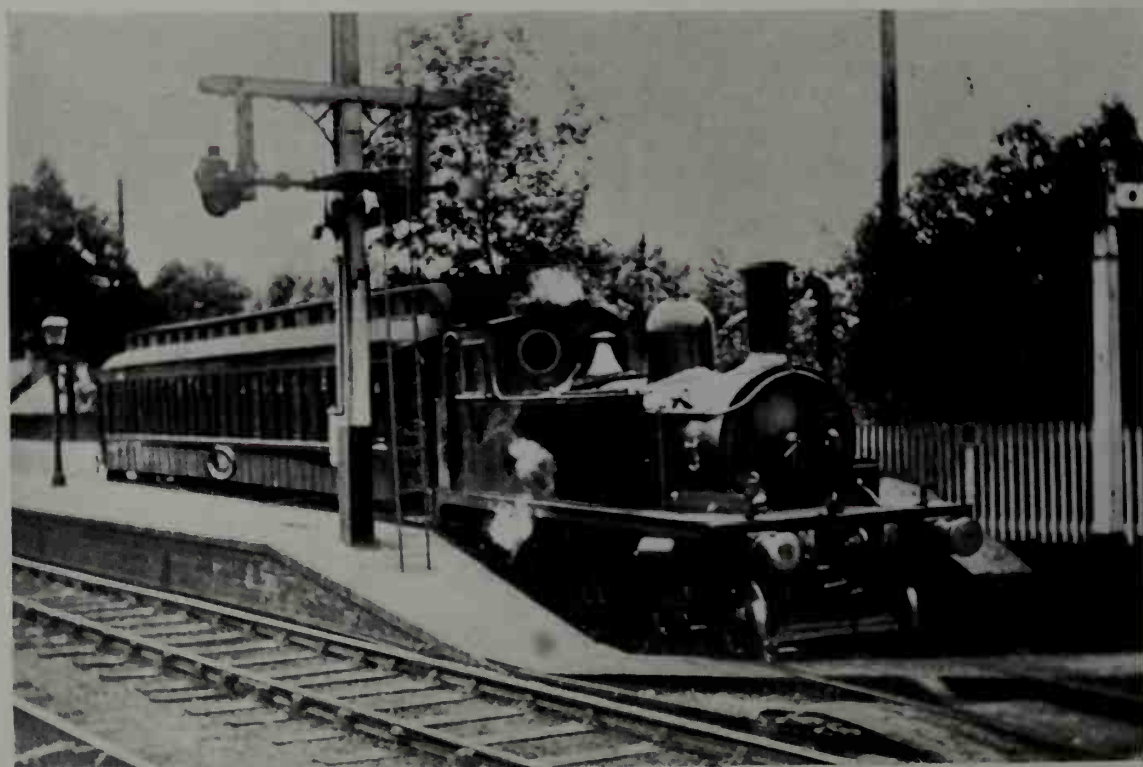
211. Far from the Russian steppes, men tunnelled the Alps, first by the Semmering and Mont Cenis routes, and then in Switzerland. The working parties on the St. Gotthard Tunnel met in the middle of the mountain at nine o'clock on Sunday morning, February 29, 1880.

212. For years the North British trains out of Glasgow, Queen Street, were helped up the hill to Cowlares by stationary engine and cable. In this view, taken in the late 'nineties, it was a West Highland train for Fort William.



213. Tracks and troughs. Midland Railway scene near Loughborough. Track water-troughs were first introduced by John Ramsbottom on the London and North Western at the end of the eighteen-fifties. They have been widely used in Great Britain, and to a lesser extent in France and the United States.

214. Our first Pullman cars lasted for many years. This Midland car ended its career in the early nineteen-hundreds as a push-and-pull unit on the Harpenden-Hemel Hempstead line. The engine is a veteran of the Lynn and Fakenham Railway, on loan to the Midland.





215. The North Eastern Railway often has been illustrated with imposing East Coast expresses. For a change, here is one of Edward Fletcher's tank engines at Leeds; built in the middle 'seventies and rebuilt in the 'nineties.



216. A West Coast express on the Caledonian Railway in the 'nineties, headed by Drummond engine No. 75.



217. Typical of Irish broad-gauge practice in the 'nineties was this express engine of the Great Southern and Western, likewise the squat, six-wheeled brake-third.



218. Most Spanish railways were built with foreign capital, chiefly French and Belgian. Great Britain had had friction with Spain, and built railways for incalculable Spanish-American republics instead. Still, there were a few Anglo-Spanish lines. One was the Zafra-Huelva Railway, of which an old locomotive, built by Dübs of Glasgow in 1883, poses here in front of the Victorian-Moorish station house at Huelva.

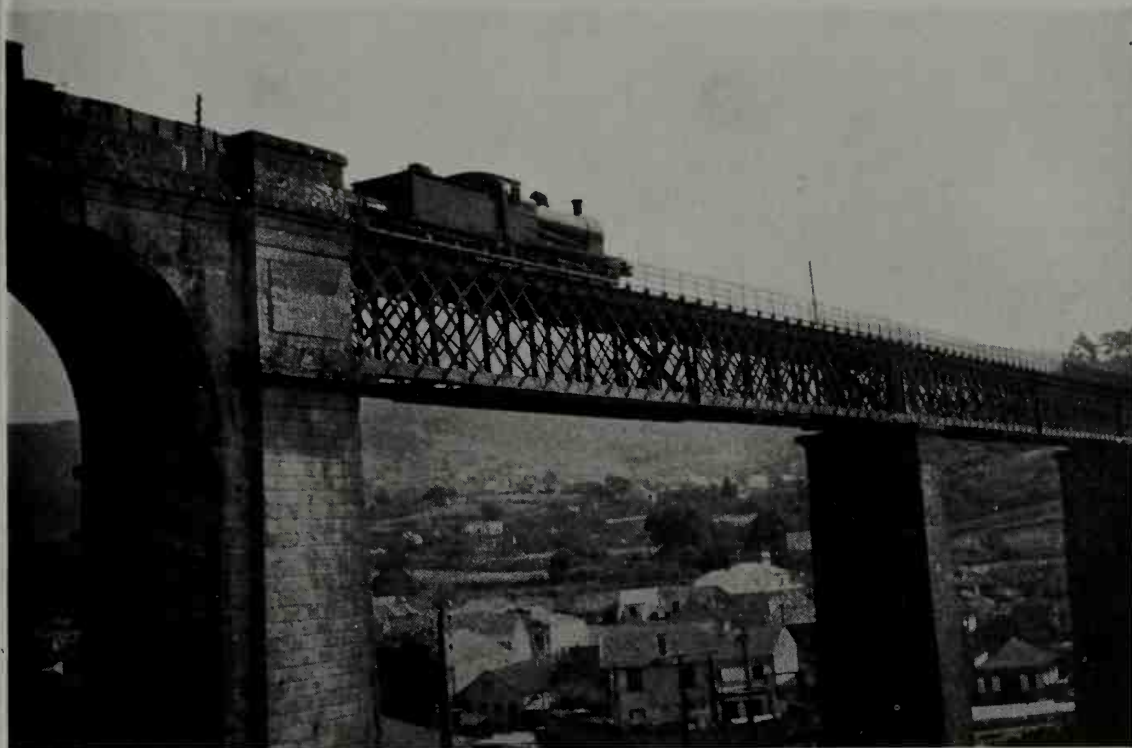
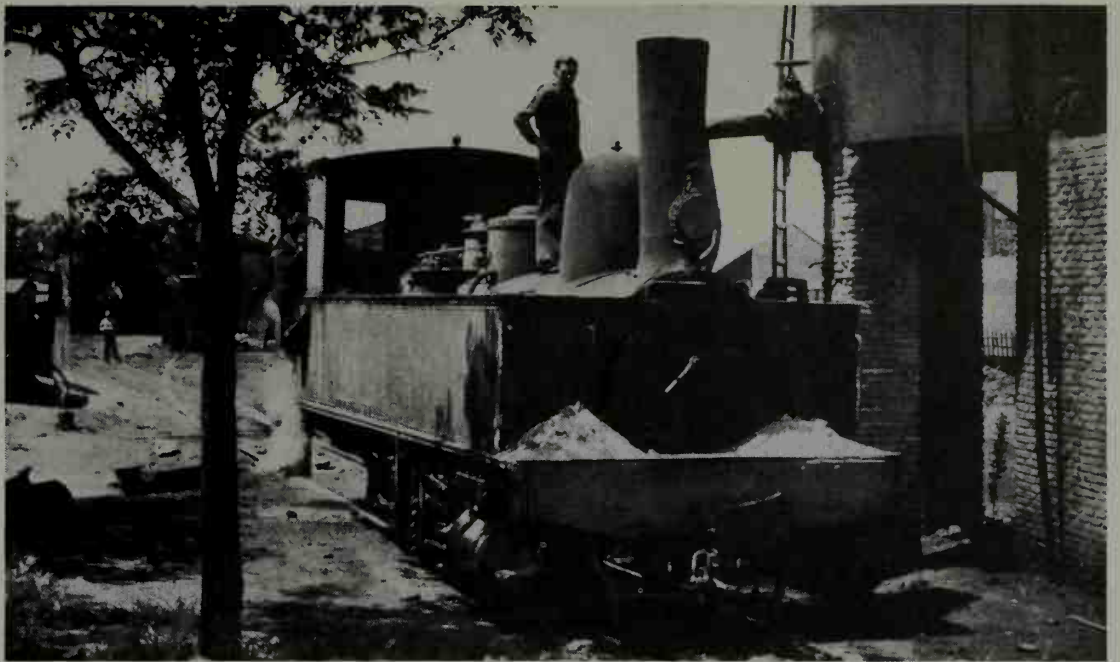


219. All the principal Argentine railways were built and worked by British companies. In the above scene (1929) the afternoon express for Buenos Aires stands in the B.A. Great Southern station at Mar del Plata. The engine is an oil-burner.



220. In Central America, the Mexican Railway was British. For many years it used Fairlie double-bogie engines on its mountain division. One of the earliest, a very obvious wood-burner, is here shown on a construction train.

221. Old Spain: The fireman sits on the front platform when sanding on a slippery gradient.



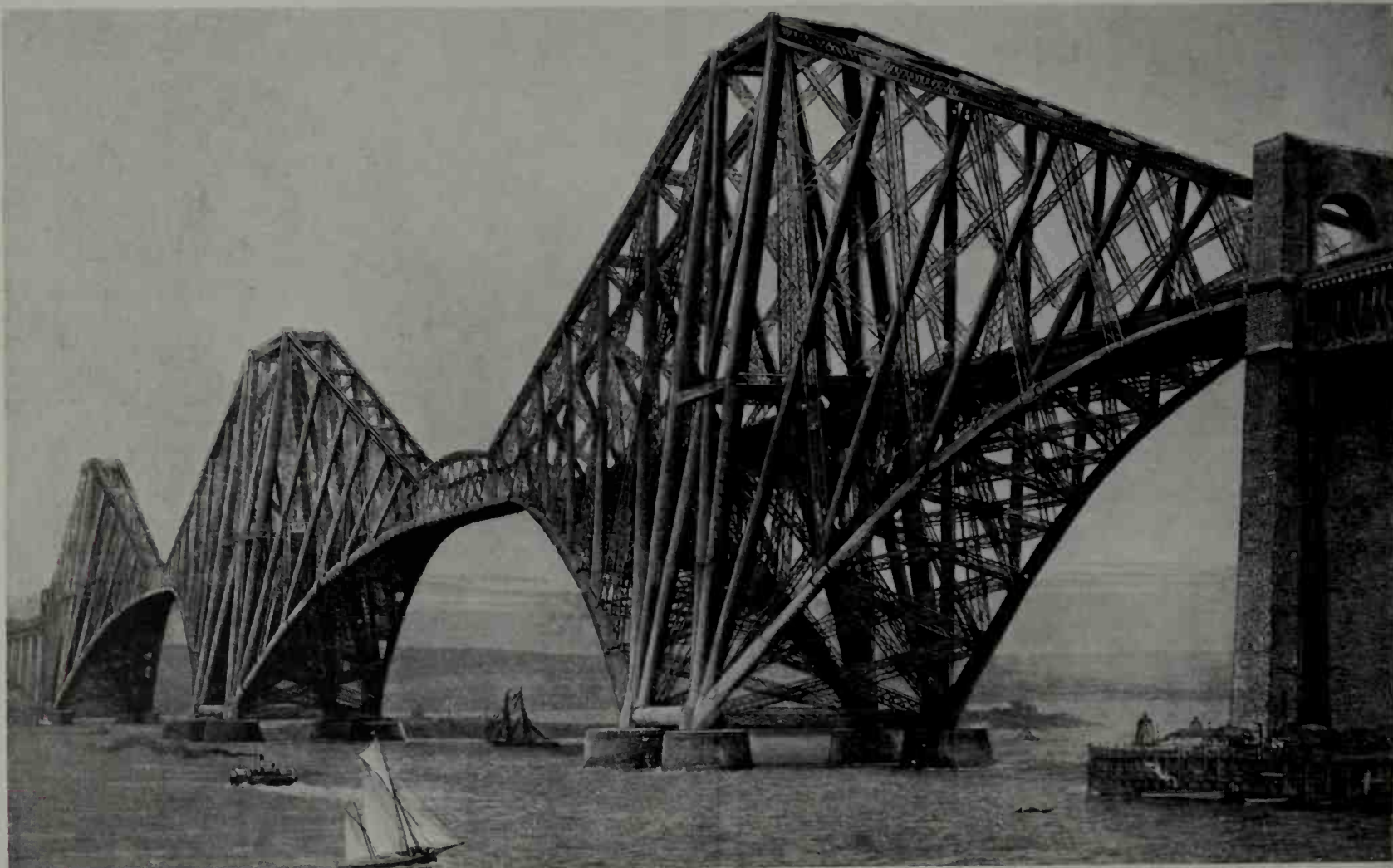
222. Redondela Viaduct on the Pontevedra-Vigo line in north-western Spain. The engine is an ex-West Galician 4-6-0, built by the North British Locomotive Company in 1909.



223. A typical Spanish broad-gauge mixed-traffic engine points south at Port Bou; to the right are the carriages of the international Barcelona Express.



224 One of the first great long-span bridges in the world was I. K. Brunel's Royal Albert Bridge across the Tamar, on the old Cornwall Railway. It was completed in 1859. Brunel just lived to see this.



225. Among main-line railway bridges, the first very-giant was Fowler's and Baker's Forth Bridge. Opened in 1890, it made a very considerable cut-off and thus completed the unbroken East Coast Route from London to Aberdeen. This lithograph shows it almost completed, and as seen from the southern shore. It had two main spans of 1,710 ft. each, and a total length of 8,296 ft.



226. There are many larger bridges than that of the Rhodesia Railways across the Zambesi, but few in a more terrific situation. This view was taken in the late nineteen-twenties, just after the addition of a motor road beside the single-track railway. The single steel arch is 500 ft long, and the height above the water 420 ft.

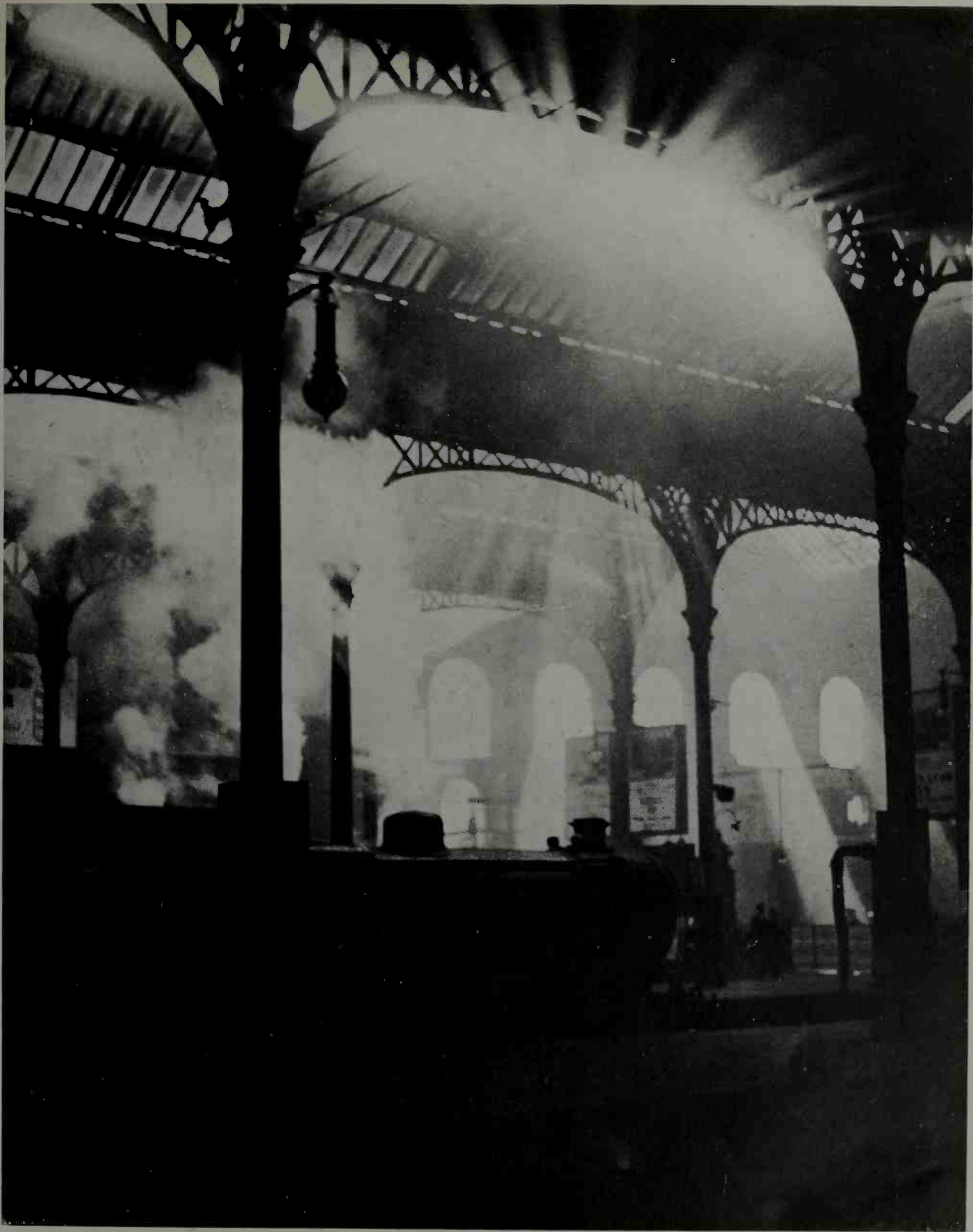


227. Ralph Freeman's Sydney Harbour Bridge, New South Wales, was opened in 1932. Dwarfing, in this view, even the Orient liner *Oronsay*, the bridge carries an electric commuter-line as well as two parallel road decks. It is about $2\frac{1}{4}$ miles long, including approaches.

228. The Great Western disapproved of the South Western. Guests for the Windsor royal garden party en-training at Paddington, G.W.R., in the summer of 1912: Two 'Star' class engines have modestly backed in. Both the rear carriages in the foreground are family saloons, and in the left background is a slip coach.



229. The South Western disliked the Great Western. Holiday travellers at Waterloo, L.S.W.R., in the summer of 1912. Men and boys wear boaters, but the women and girls wear heavy coats and skirts. The frame of the present station begins to engulf the old buildings (right back-ground). The trains include a Kingston Roundabout at Platform 2, and a relief Bournemouth express at platform 3.



230. The Great Eastern was a law unto itself. Sunshine and smoke on a February morning at Liverpool Street, London.



231. St. Pancras, London, in the nineteen-twenties, with a Midland compound engine heaving a night Scotch express into motion. An aged Kirtley tank engine (1871) looms dimly on the right.



232. Distinguished station buildings are to this day rare in Great Britain, but in Ireland, Dublin shows the stately front of Heuston, which for more than a century was called Kingsbridge. It is one of the most beautiful railway buildings in Europe.

233. York, North Eastern Railway: South end of the station in the nineteen-hundreds, with its beautifully symmetrical layout. Standing in the station are, from left to right: a North Eastern train with an old Fletcher engine; a Midland train; an East Coast express with a North Eastern 4-6-0; a Midland engine (behind signals); a Great Northern small Atlantic waiting to take over the East Coast express; the Continental express to Harwich, with a Great Eastern bogie single; and a Great Northern train. The carriages on the extreme right are Midland; beyond are the towers of the Minster.



234. At Newcastle-upon-Tyne in the nineteen-twenties. Portentously looms the new great road bridge; on the left is the old High Level Bridge (see 61); an East Coast express is pulling out for Edinburgh, behind an early Gresley Pacific; the roads in the foreground are electric, but the locomotive standing on them, below the inner home signals, is an old Fletcher tank engine of the eighteen-seventies. The castle dates from the eleven-seventies.

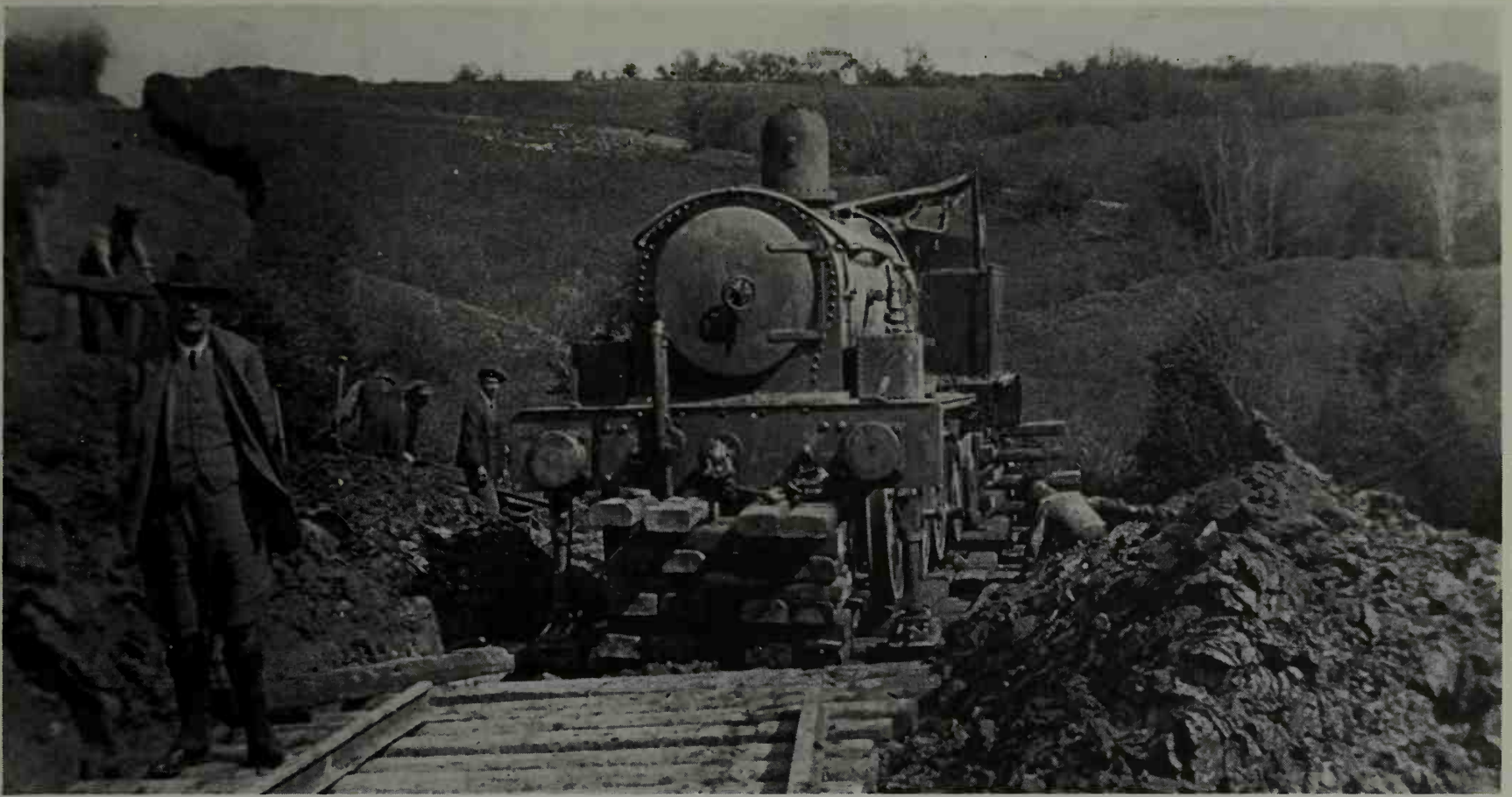
235. Exeter, Queen Street, London and South Western Railway, in the nineteen-hundreds. The old twin barn of a station dated from 1860 and lasted just over sixty years. The visible engines, from left to right are: Drummond 4-4-0 No. 727, Adams 4-4-0 No. 576, and an Adams 0-4-2 'Jubilee'.



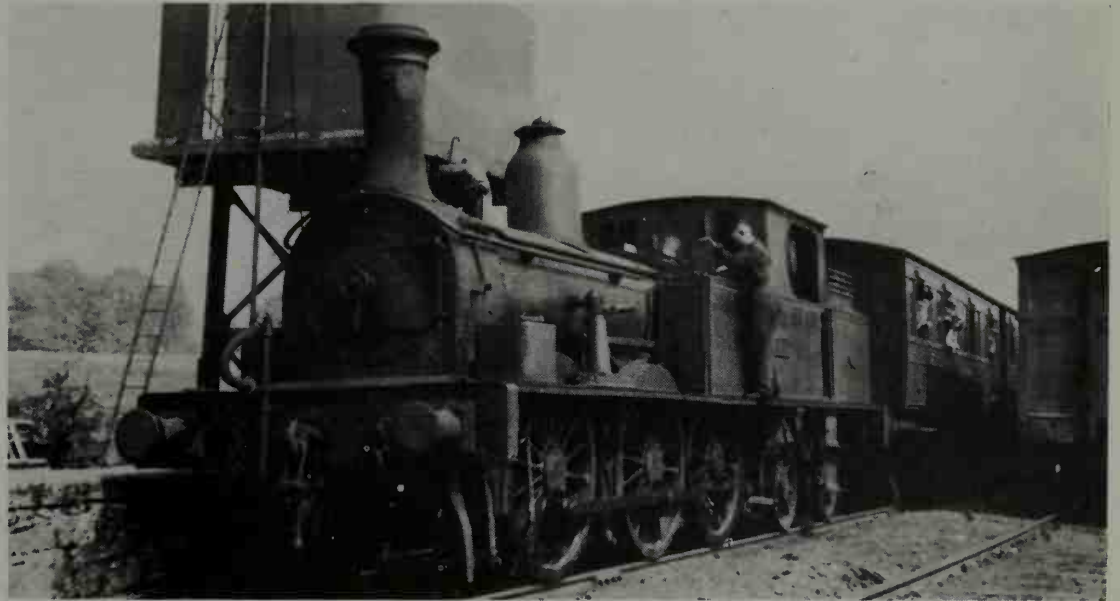


236-7. Narrow-gauge in Ireland could produce quite imposing effects. Above is an up Killybegs goods train at Stranorlar, County Donegal Railways, with 2-6-4 tank engine *Columkille*. The C.D.R., it should be remarked, was the pioneer in these islands of oil-engine traction. In the lower view, on the Tralee and Dingle line of Coras Iompair Eireann, a double-headed cattle train bellows on its way through the mountains of Kerry.





238-9. In civil war, railways are regarded as fair game by irregular forces. During the Irish Trouble, the Sligo, Leitrim and Northern Counties Railway did not escape. Among other misfortunes, it had a train derailed on Glenfarne bank. The upper view shows its old Beyer Peacock tank engine *Hazlewood* being recovered. She rolled over several times on her way down the embankment, but landed upright with the boiler full of water. Repaired, she survived the ordeal for many years. The middle view shows her at Colooney in 1947.



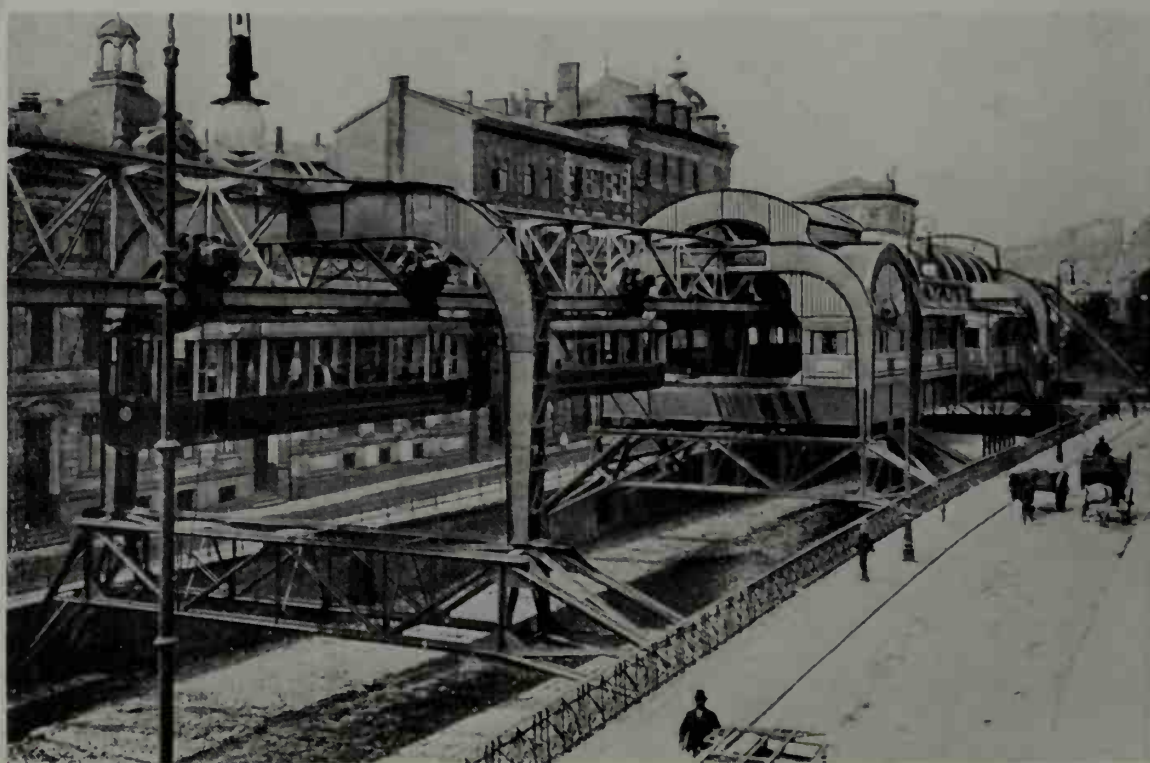
240. For the best part of a century, a horse tram-car worked the Fintona branch of the Great Northern Railway of Ireland. With truly Irish irony, the horses on the branch lasted as long as did steam on the through-line, and then the railway died in those parts.

241. Before the opening of the Mont Cenis Tunnel in 1871, J. B. Fell built, on Napoleon's road over the pass, a line in which the locomotives gripped a central horizontal rail. It had its hazards, especially at avalanche time, but for three years it carried passengers, goods and the overland Indian Mail.



242. Lartigue's mono-rail, with guide rails at the side, was tried on the Continent, and in Ireland on the Listowel and Ballybunion Railway, which worked thus from the 'eighties until 1924.

243. Most successful, and a true mono-rail, was the Wuppertal Railway in Germany, on Langen's system, working a frequent service of suspended electric cars. It has survived both the years and heavy bombing.



244-5. The Railway Bus: Above is one of the famous 'red umbrella' buses of the Metropolitan Railway weaving through Victorian London near the Bank, with the smartly uniformed cad on his step at the back. This one was on inter-station service, as was the London and North Western Railway bus in the lower view, taken in the court of Euston Station.



246. The railway companies were pioneers of country motor bus services. Left is one of the Milnes-Daimler motor wagonettes, first worked by Sir George Newnes in connection with the Lynton and Barnstaple Railway and then put on by the Great Western, between Helston and The Lizard, in 1903.



247. Amsterdam Central: High platforms and the old Beyer Peacock seven-footer bespeak English influence; the flat-roofed side-door carriages could be nothing but Old Dutch. This view was taken in 1929.



248. Rotterdam's bridges before the bombing of 1940.



249. Antwerp's ornate station on the Belgian State Railways exemplifies a nineteenth-century style which might be called Crystal-Palace-Decorated.

250. British, French and German influences all went into the forming of native Italian practice. The first is strongest in this Italian train at Certaldo, on the Empoli-Siena-Chiusi line, about 1922. Its engine came from the Italian Southern Railway: the carriages are standard Italian State stock.



251. The south end of Copenhagen Main Station in 1929. The German-built engine, like all of the Danish State, wears the national colours round the chimney, which has a concentric outer casing like a ship's funnel.



252. A mountain engine of the Norwegian State Railway barks her way up through the foothills of the Dovrefjeld.

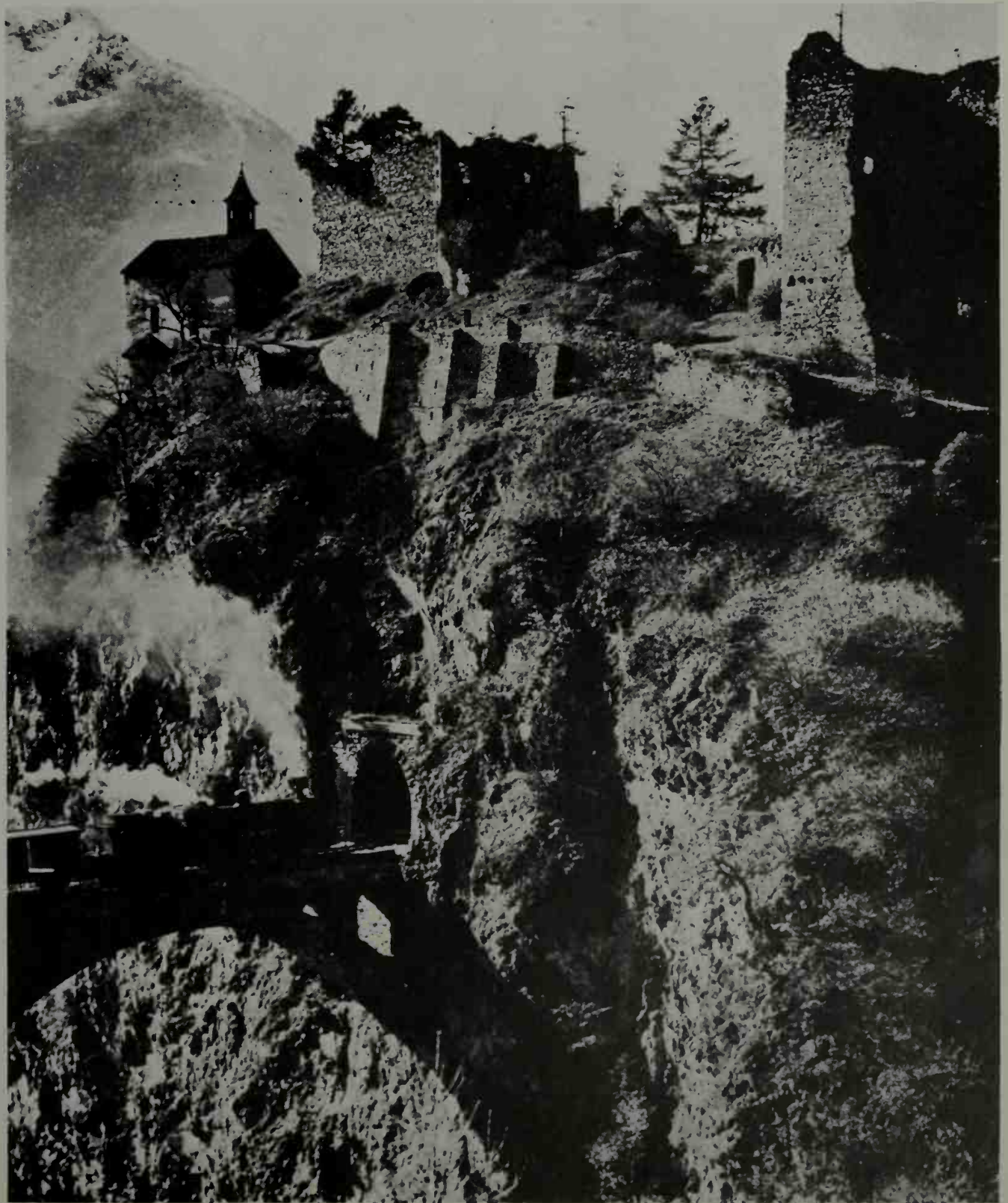
253. Cologne: a misty morning. View from the old Rhine Bridge, about 1900. A northbound express of the Prussian-Hessian State Railways pulls out of the Central Station below the Cathedral.

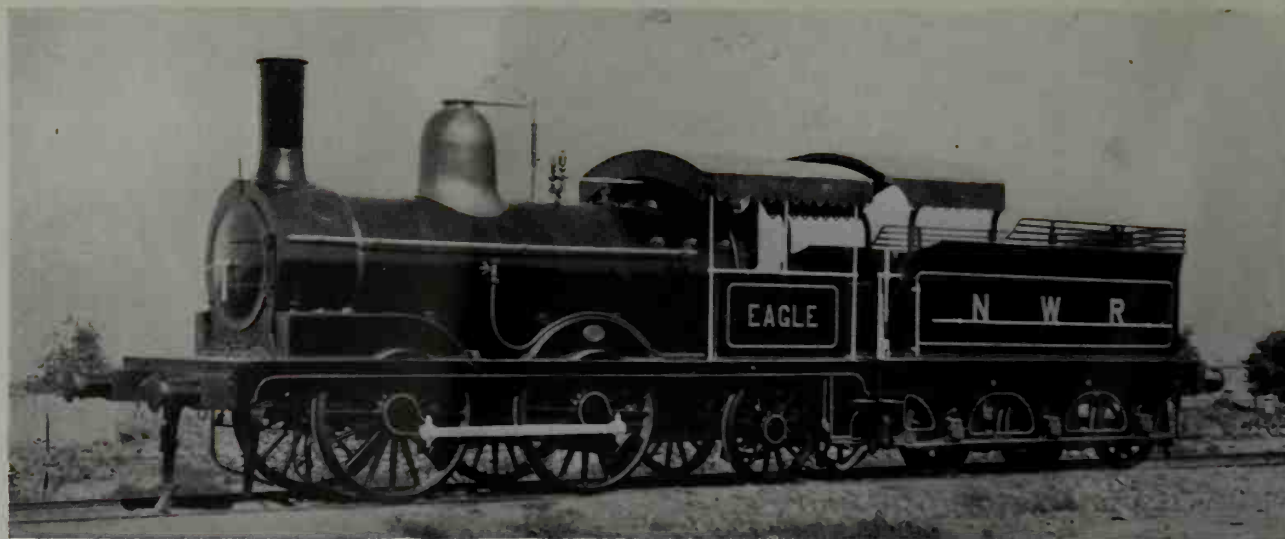


254. Near Saalfeld, 1924. A Berlin-Munich day express rumbles south behind a Prussian P 8 and a Bavarian Pacific: the carriages are Bavarian, with a Mitropa diner.



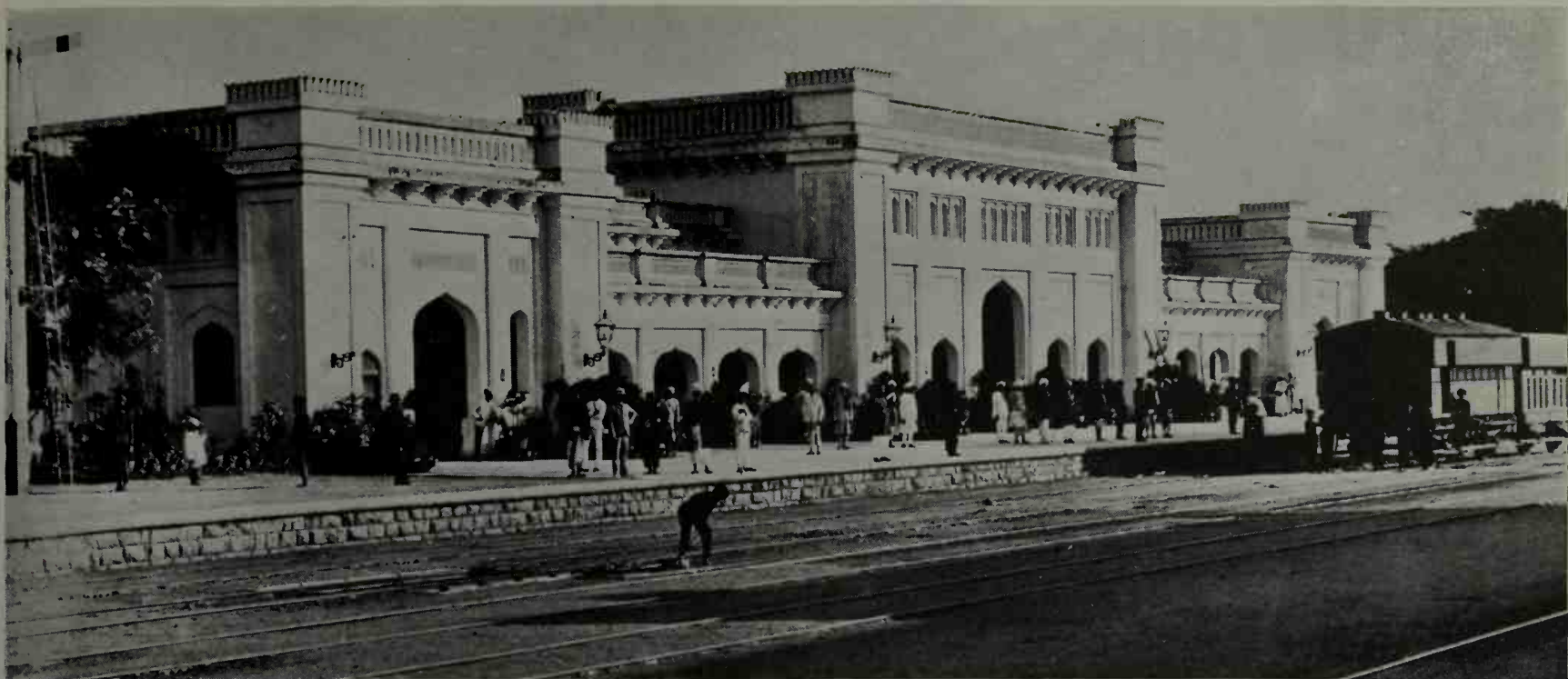
255-6. Austria: Left, a goods train comes off the international bridge at Passau, between Austria and Lower Bavaria. In the lower view, a train dives under Falkenstein on the Tauern line, Carinthia. Both the engines shown are lignite-burning 0-10-0 of Gölsdorf's design.





257-9. India, North Western Railway. Recent developments divided the N.W.R. between India and Pakistan but under the Raj it was a very potent factor in its huge, rough way. Above is one of its oldest engines, the *Eagle*, originally built for the Scinde, Punjab and Delhi Railway in 1869. The middle view is from India proper: the water-carrier revives the third-class passengers, who first rinse their mouths over the side and then drink. Below, a view from the nineteen-twenties; in the hot dawn a stodgily capable 0-6-0 goods engine hoists the Frontier Mail into the hills. Speed is neither important nor, indeed, possible.



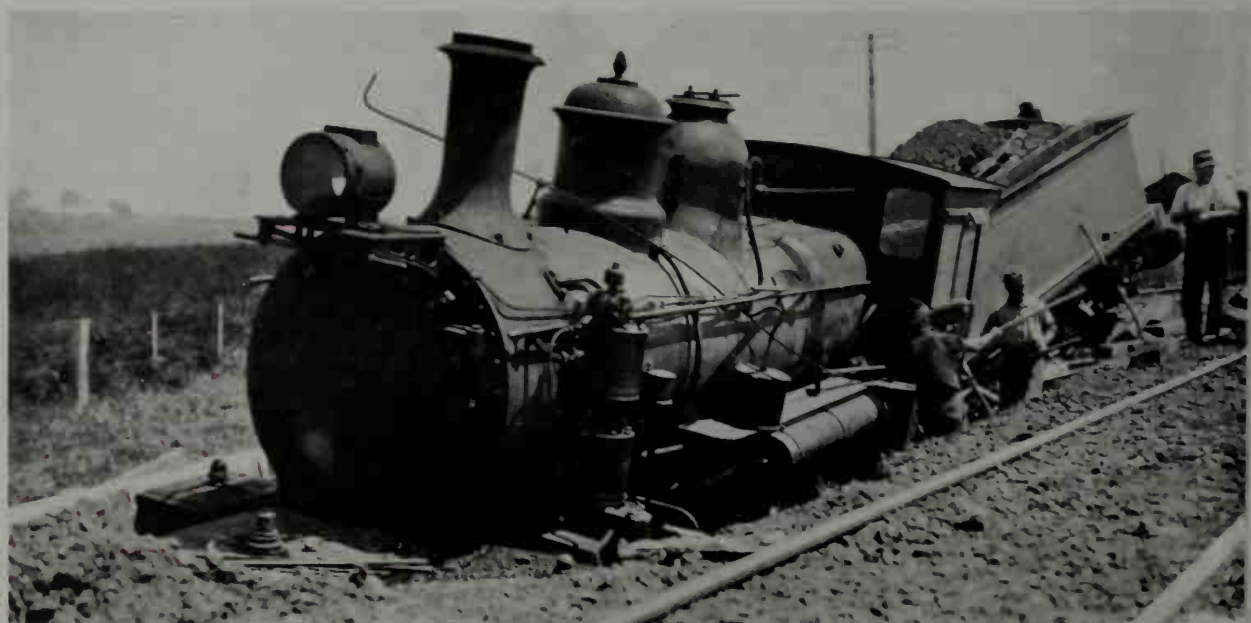


260-3. The Eastern scene: Above is Hyderabad, late in the last century. An Exalted Personage appears to be expected, there are no crowds and no visible chewing of betel-nut. Flowering shrubs adorn the platform. Left centre: On a metre-gauge branch, no Exalted Personage is expected, but that does not trouble the sacred monkeys, who wait for whatever the third-class passengers may throw out of window. On the right is a view on the Colombo-Kandy line, Ceylon, in 1867, and below, a characteristic head-end view at Karachi.





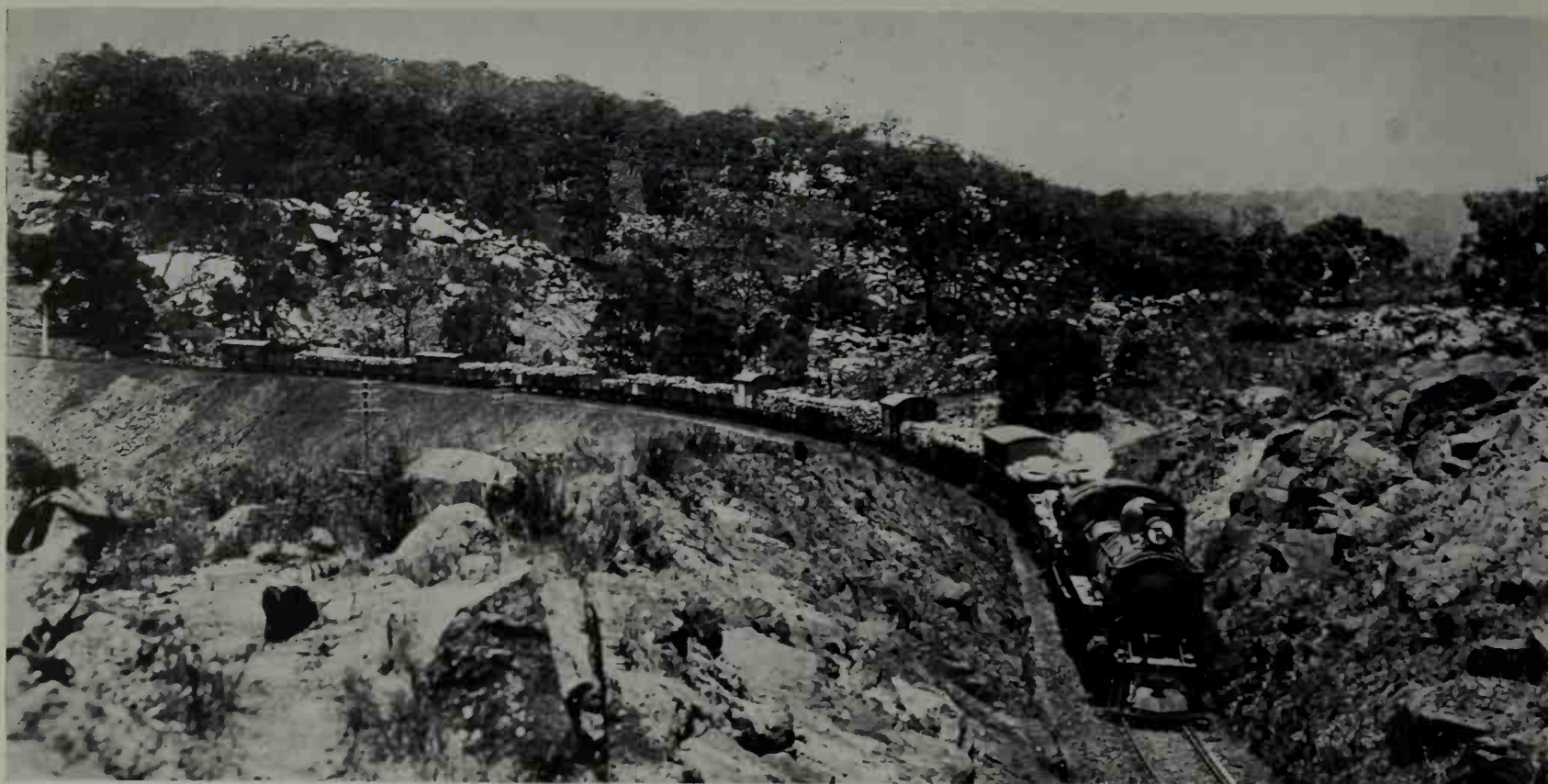
264-6. Engines of old New Zealand. At the top is a Neilson tank engine, small even as small engines went; the driving wheels were $36\frac{1}{2}$ in. and the leading wheels 18 in. in diameter. In the middle is an American-built engine (Rogers), turn-tabled in what might be a Sussex chalk cutting. At the bottom, a Nasmyth Wilson 2-8-0 of 1885, at Pokena, has become the victim of misplaced confidence.





267-9. New Zealand, more recent views: Above is a class J 4-8-4 crossing Hamilton Bridge, over the Waikato River, with an Auckland-Rotorua express. In the middle another 4-8-4 engine, of class K, climbs out of Auckland. The bottom view is of Cross Creek Shed, at the foot of the Rimutaka Incline, with four of the Fell banking engines (see 241). Following the construction of a deviation and a tunnel, the famous Fell line is now abandoned.

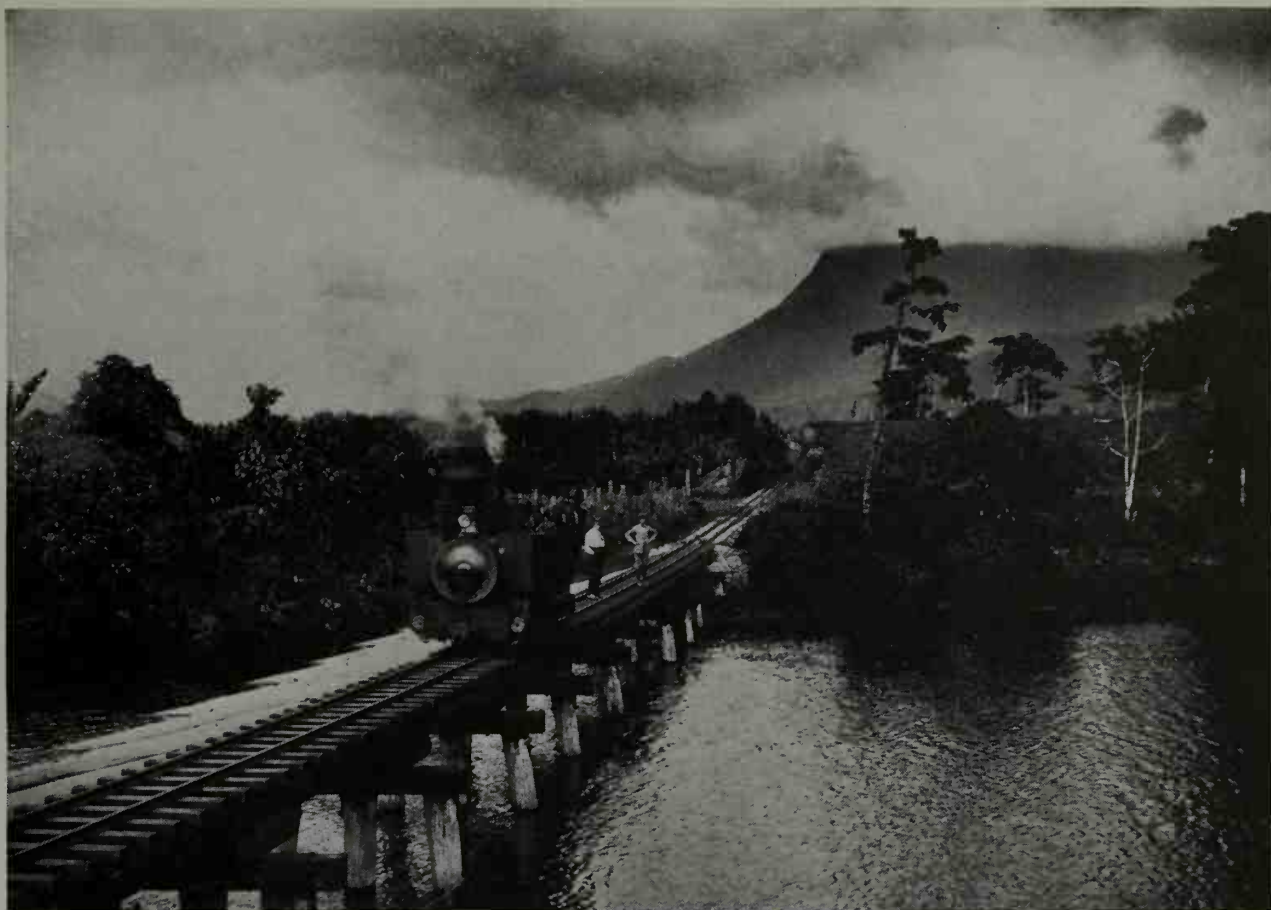


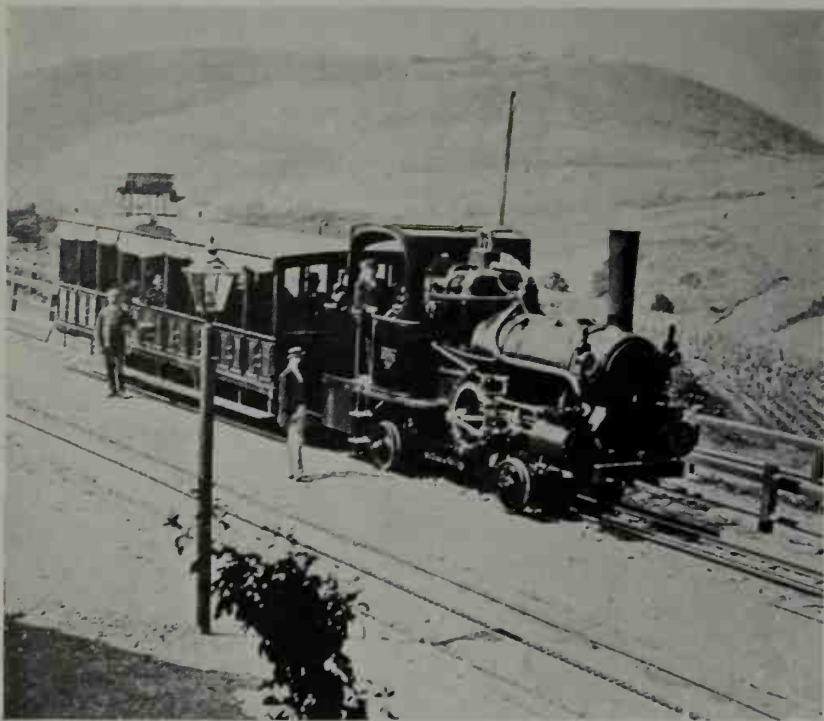


270-2. The Steam Age in Australia. Above, a pick-up goods weaves down the eastern main line of the Western Australian Government Railways. In the middle, the inaugural Trans-Australian train leaves Kalgoorlie, W.A., for Port Augusta, S.A., on October 25, 1917. Below, an old Beyer Peacock engine with a mixed train toddles past the fruit farms of Tasmania.



273-4. Australian contrast. Above is the trestle of a sugar plantation line in northern Queensland, with Billindenker Mountain cloud-capped beyond. The little tank engine, muzzled with a large diamond stack, burns sugar-cane trash. Below, a Class D57 4-8-2 with conjugated valve-gear pulls out with a night goods (New South Wales).





275. Steep-grade mountain railways became possible with the revival of the rack-and-pinion arrangement, with the rack between the rails and the engine geared down to a spur-wheel engaging with it. Riggenbach's system involved a single ladder-rack. This was his pioneer rack railway on the Kahlenberg in Austria, 1866.



276. Most famous of mountain railways built on the Riggenbach system was the Vitznau-Rigi Railway by Lake Lucerne, partly opened in 1871 and, throughout, in 1873. Vertical boilers were used for the earlier locomotives. This view of Freibergen station, with trains crossing, shows one engine rebuilt and the other with the old boiler, also the sector table used instead of points.



277. The Abt system, unlike that of Riggenbach, employed two parallel racks with the teeth staggered, and was widely adopted on Swiss mountain railways, including the Jungfrau Railway. This, at Jungfraujoch, has the highest station in Europe, 11,340 ft. above sea level.



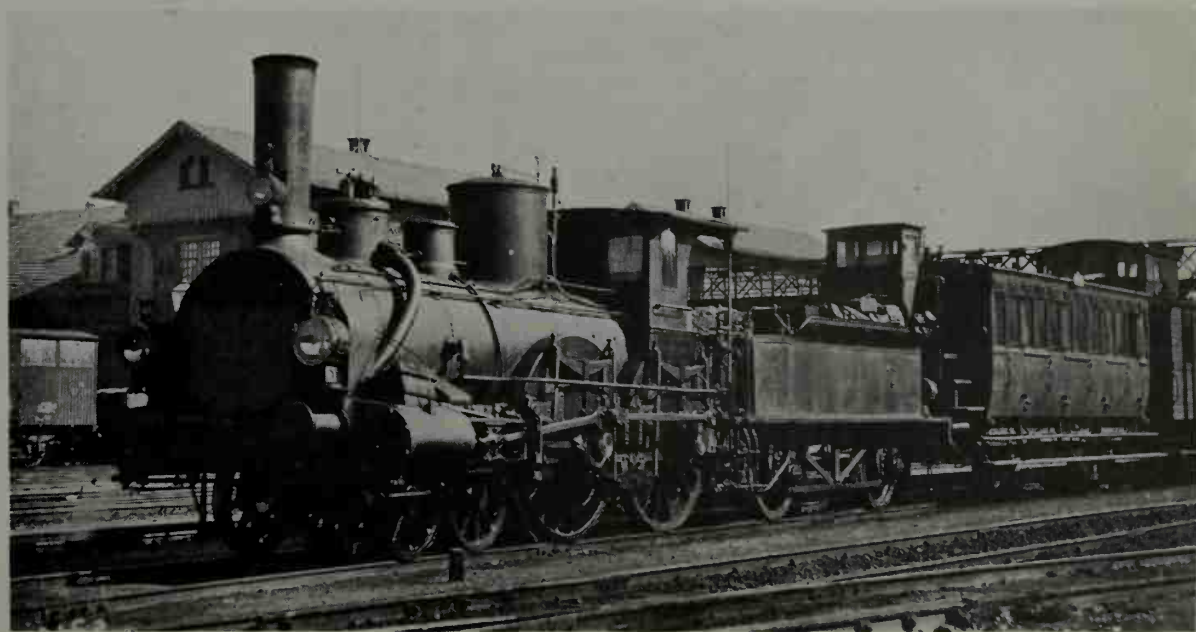
278. A late-comer among mountain rack railways was the Bavarian Zugspitze Railway, which, like the Jungfrau Railway, has part of its upper section inside the mountain. In this view, an electric train on the lower section climbs demurely through the hayfields below the Wetterstein massif.

279. Austrian byway: Simmering through the afternoon at Maierhofen, Tyrol, is a train of the Zillertal Railway. The view was taken in the early nineteen-twenties, and was to remain unchanged for many years longer. Improbably but truly, one of the locomotives is at present on the Welshpool and Llanfair Railway in Central Wales, with some Austrian cars as well.



280. Rheingold Express: The show train of the German State Railways in the late nineteen-twenties and after, running from Hook of Holland to Basle, runs south by the Rhine on a hot spring morning, headed by a transferred Bavarian Pacific.

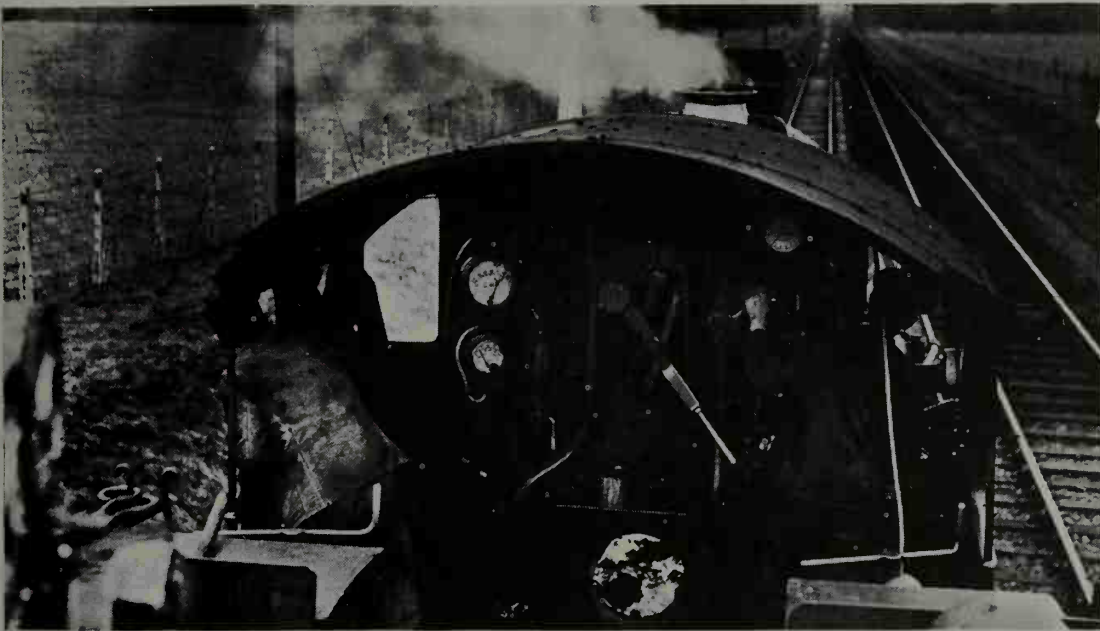
281. Out of the German past: An old Badenese engine, built at Karlsruhe in 1861, shunting at Basle early in the present century. The combination of outside cranks and valve gear with double frames was initiated by Maffei's Englishman, Joseph Hall (see 81). Next the tender is a peculiarly choice second-class carriage.





282-4. Miniatures: Percival Heywood was pioneer of the passenger-carrying miniature railway, and built one with 15 in. gauge in his superb gardens at Duffield Bank, Derbyshire. Above is his first engine, *Effie* of 1875. Like all his locomotives, she had a launch-type boiler. In the middle is *Southern Maid* on the Romney, Hythe and Dymchurch Railway, a joint creation of J. E. P. Howey and Henry Greenly. Following the example of the converted Ravenglass and Eskdale Railway (1915), the line both amuses and seriously transports. During the war, 1940-5, it ran an armoured train. The 'children's railways' in Russia also serve a double purpose; they please the newest generation and teach the apprentices. This one, a full-size narrow-gauge rather than a true miniature, is at Dnepropetrovsk.





285-7. The Cab. Above is that of a Great Northern Atlantic of the nineteen-hundreds. British locomotive cabs were for long very simple as to equipment, and as shelters, skimpy. The middle view shows the cab of a 'Castle' class engine on the Great Western, 1923. It is certainly an improvement on the Great Northern, and is equipped for automatic train control. Below, Metropolitan Railway: Underground engines had no cabs.



288. There is nothing particularly recent in streamlining of trains. This was F. U. Adams' experimental 'Windsplitter' in 1900. The rear of the train is shown on the old viaduct at Relay, Maryland, built by the Baltimore and Ohio Railroad in 1835. At the head end there was an ordinary American-type locomotive.



289. Through springtime woods. The scene is on the Canadian National Railways near Bartonville, Ontario. It is less obvious that the photograph was taken in 1943.

290. From the narrow-gauge era in Colorado, U.S.A., c. 1910. A small but substantial train of the Denver and Rio Grande crosses Crystal Creek bridge near Gunnison, Colorado.



291. Zerea Road Station, Durban, on the Natal Government Railways in the early nineteen-hundreds. The footbridge is straight out of Great Britain, the carriages are Victorian-Colonial at its best, and the locomotive is a tank engine from Dübs of Glasgow. The porters are Kaffirs; the passengers include an Indian with his lady in sari; a group of girls in 'sailor' hats; and an Englishman with bowler hat and umbrella.



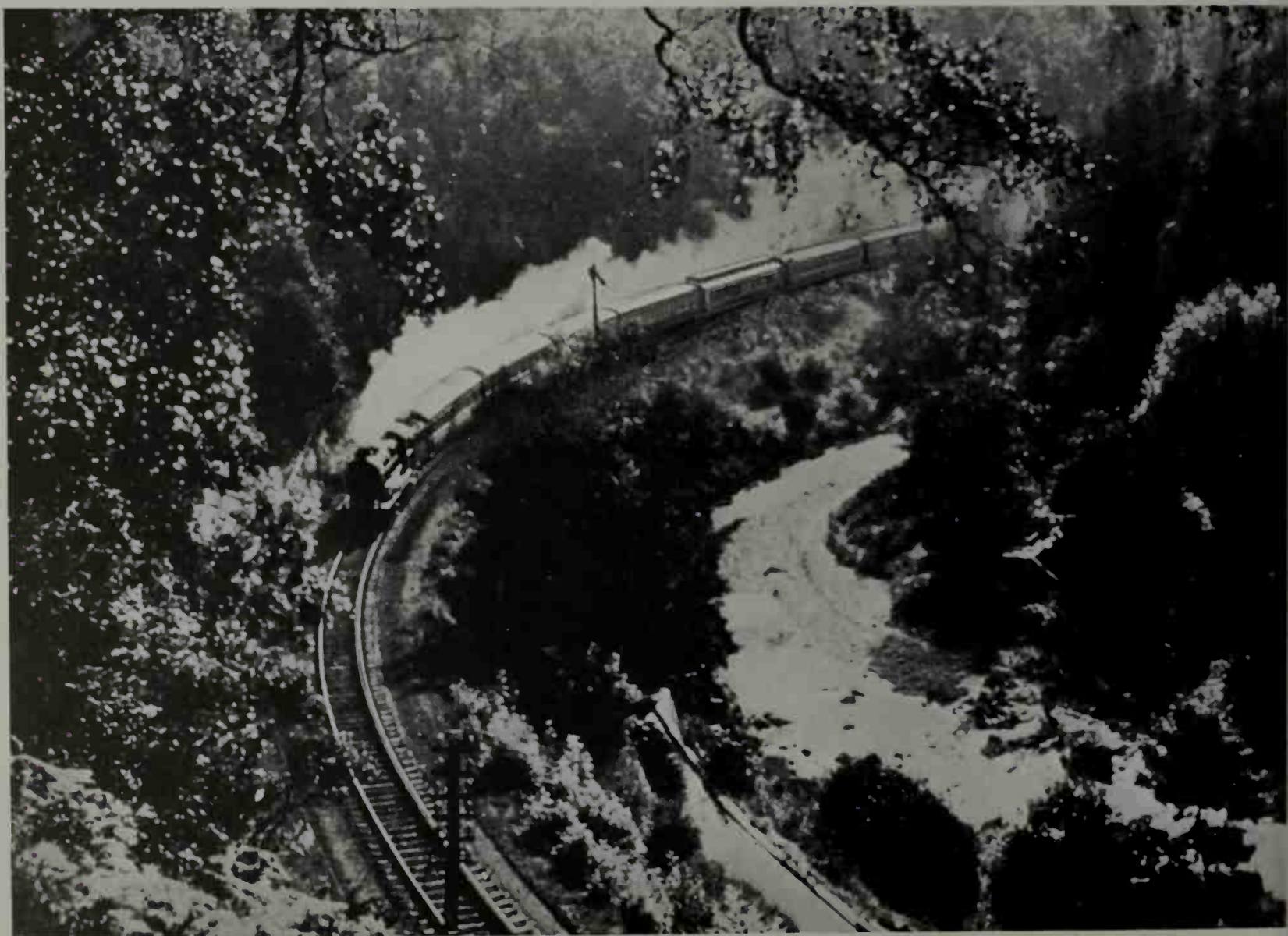
292-3. During three years' war at the end of last century, railways in South Africa suffered much wrecking, not least in the last, guerilla phase. The left-hand view shows repairs being carried out at Charlestown Tunnel, Laing's Nek, on the Natal Government Railways. On the right is a long-distance train of the Cape Government Railways at Bushman's Kop, in the years following the war. All the engines are by Dübs.



294. Cape Town Station, Cape Government Railways, in 1896. The visible rolling stock is in a transitional phase, with the clerestoried corridor carriage on its way in.



295-7. Through deep valleys, across loch and estuary and over bleak watershed, the railway had brought the first trickles of a returning life-stream to the empty Highlands of Scotland. Above is the cantilever bridge of the Callander and Oban Railway's Ballachulish branch across the narrows of Loch Etive. On the right is Joseph Mitchell's viaduct at Killiecrankie, where the Highland main line climbs into the great hills. Below is the Great North of Scotland line through Glen Fiddich, east of Craigelachie. All three views were taken during 1930-2.



298-300. Across the shallows of Loch Fleet in Sutherland, Thomas Telford built a causeway early in the nineteenth century. Highlanders, making suitable understatement of a Lowlander's work, called it The Mound. In 1902, the Dornoch Light Railway was added at one side. Road and railway span the tidal waters by viaduct at the northern end. This photograph was taken, incidentally, in an interval of watching an eagle being buzzed by two hawks. In the foreground is The Mound Junction on the Highland main line. The Dingwall and Skye Railway furnished a link to the Isles, first by Strone-Ferry and later by the Kyle of Lochalsh. In the middle view, an up train takes water at Achnashellach. The engine is one of David Jones's big goods of 1894, the first of the 4-6-0 type to run in Great Britain. Below is a Highland local train at Brodie in 1935, headed by two Drummond engines, *Ben Clebrig* and (leading) an old Barney goods whose water-tube firebox long outlasted the others.





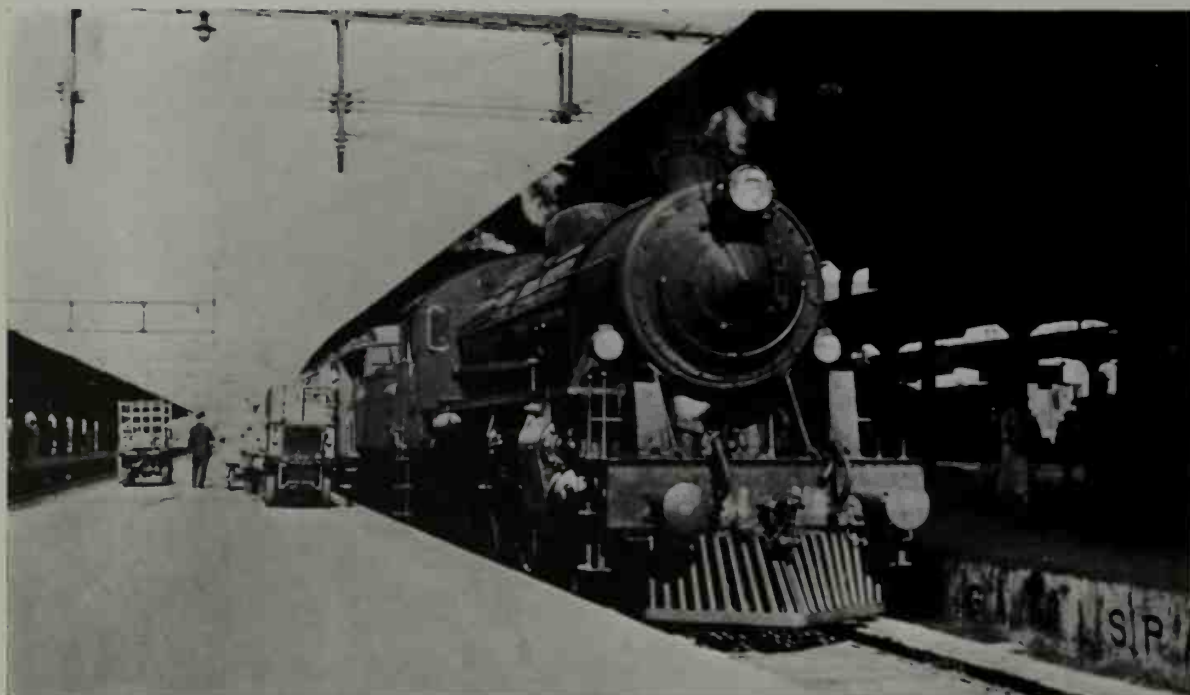
301-3. Electrification of steam railways was pioneered by several northern companies: by the Mersey Railway (1903), the Lancashire and Yorkshire and the North Eastern (both in 1904). Above is a Manchester-Bury train on the L. and Y.R. (1915). On the left is a third-class carriage on the N.E.R. Northern Tyneside line (1904); and on the right is a London and North Western electric train at Euston in 1922.



304-6. First of the Southern companies to electrify a steam line was the London, Brighton and South Coast, which used alternating current with overhead conductors, on the South London line in 1909, and subsequently on the Crystal Palace group of lines. The London and South Western, from 1915 onwards, used d.c. with third-rail contact, and the middle view shows one of its trains at that time, between East Putney and Southfields. The fourth-rail return was for the accommodation of underground electric trains off the District Railway, which had been running over the L.S.W.R. since 1905. The South Western's system was eventually adopted for all the Southern Railway. The lower view was taken at Ascot in 1938 and shows one of the L.S.W.R. Drummond tank engines with its austere successor.



307. The steam age in Sweden produced prodigious variety of steam locomotives, belonging to scores of railway companies, using various gauges. The Gothland Railway, like many others, adopted 2 ft. 11 in. (or 891 m.: either way it was eccentric). Here, Gothland No. 2 shunts on the quay at Visby in the middle nineteen-thirties.



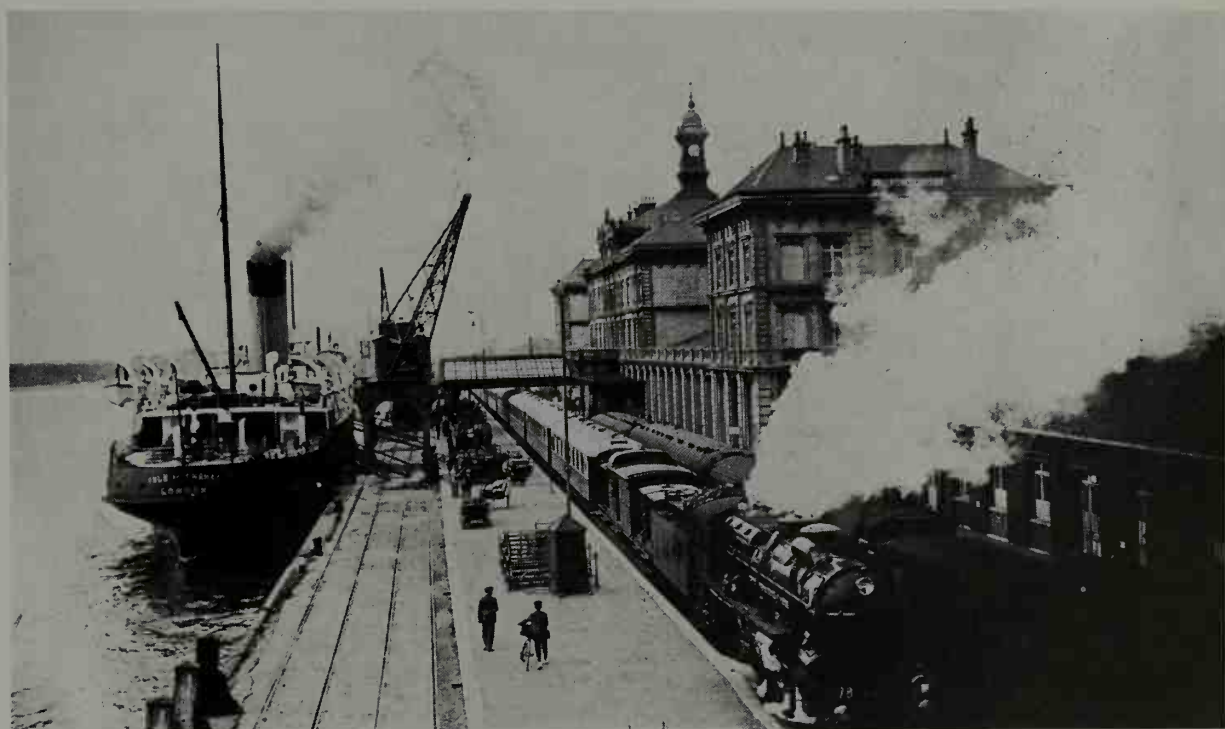
308. Largest of the Swedish systems, after the State Railways, was the Bergslagen Railway, running north-east from Gothenburg, where this view was taken, in 1937, of a three-cylinder simple express engine heading an international train with through carriages from Norway to Germany.

309. Single-driver tank engine No. 9 of the Kalmar Railway heads a coach-and-van train (one of each) in front of the white post-Baroque station at Kalmar (1937).

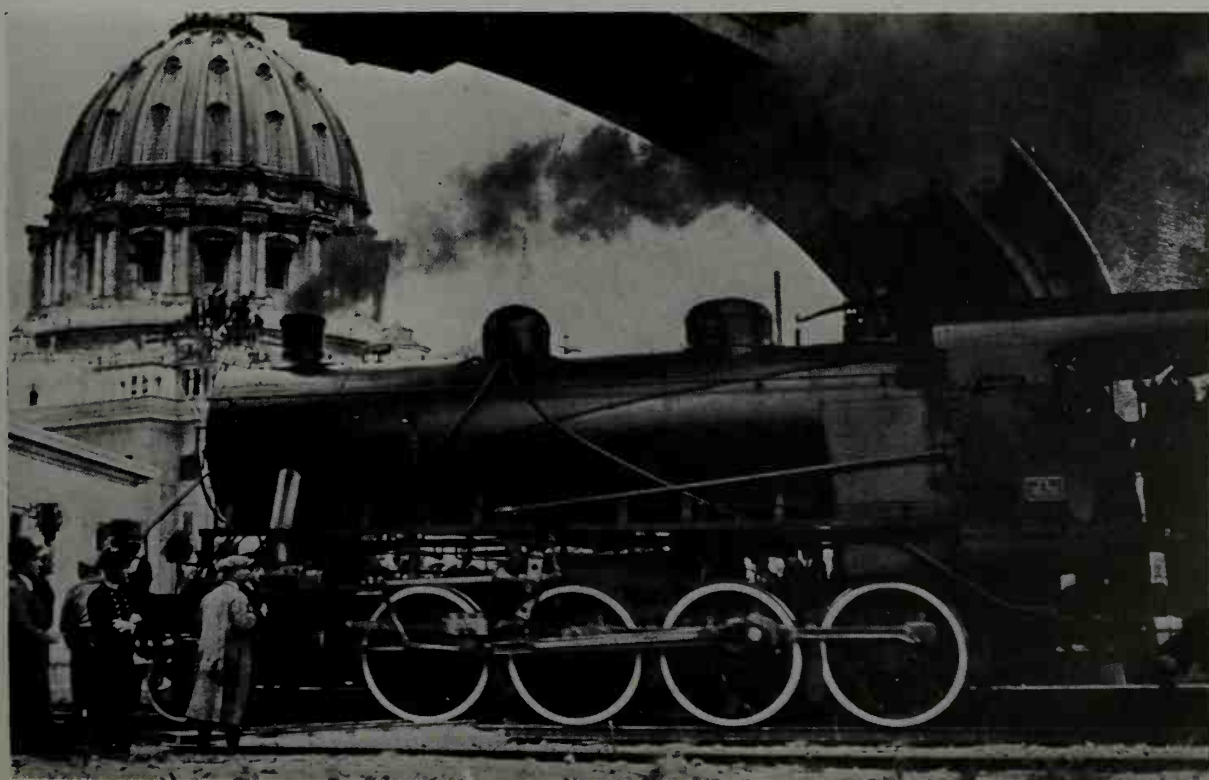




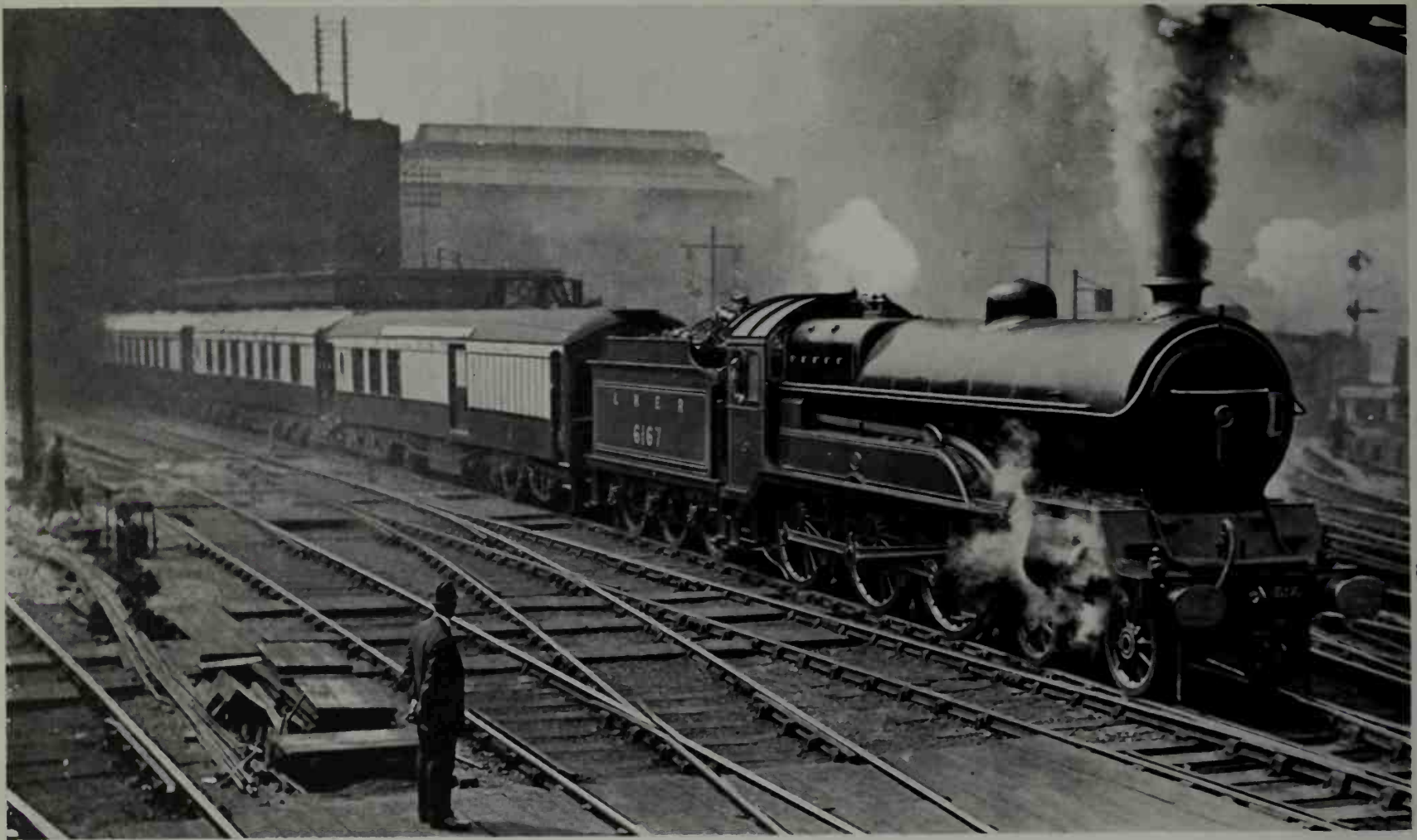
310. In the Gare de l'Est of Paris is a supreme example of successful rebuilding. The façade is a doubling, with a new intermediate block, of the original one built under the Second Empire for the old Paris-Strasbourg Railway.



311. This view of Calais Maritime in the nineteen-twenties shows the old station and hotel building which were destroyed in the fighting of 1940. The train is the Golden Arrow on its maiden run, headed by a Nord Pacific, and the ship is the Southern Railway's *Isle of Thanet*.



312. On a morning of 1932, an Italian State 2-8-0 brings the first train into Vatican City, below Michel Angelo's great dome of St. Peter's.



313. Forty-nine years after Pullman cars had first worked to Scotland (by the Midland), they were run again between London and Edinburgh by the East Coast. This is the inaugural Queen of Scots leaving King's Cross on July 13, 1925, headed by an ex-Great Central engine.



314. Steam in the landscape. *Winchester Castle*, one of the famous Great Western class (see 286) beats up the Golden Valley to Sapperton Tunnel on a spring evening of 1955.

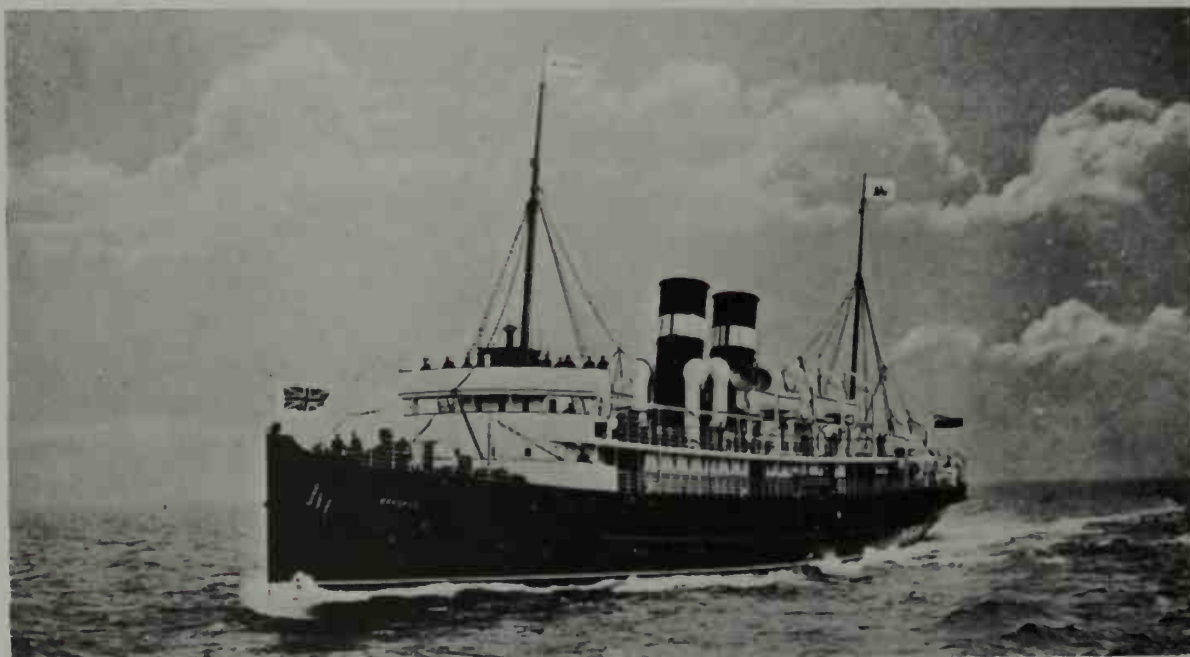
315. (*Right*) For well over a century, locomotives have shouted their way up the 1 in 37 incline in the Lickey Hills between Gloucester and Birmingham. Here, banking a goods train, is the Midland four-cylinder ten-coupled engine, at one time the most powerful locomotive in Great Britain, which was on the job from 1919 to the coming of the Diesels. Both this and the lower view belong to the nineteen-fifties.



316. (*Below*) Engines, clouds and girls. A Bournemouth-Liverpool express takes the Lickey Incline with two tank engines banking in the rear. The lower view belongs to the nineteen-fifties.



317. Railway-owned steamer services began early, chiefly in the narrow seas, but also on the lakes. The Furness Railway's steamer *Gondola*, built in 1858, was not the sort of craft one encounters every day. Nor, for that matter, was the *Lady of the Lake* (1908). Here they are both at Waterhead Pier, Coniston Water.



318. A most elegant steamer was the Midland Railway's *Manxman II*, built for the Heysham-Belfast service in 1904. Later, she was an aircraft-carrier in Turkish waters, and in 1920 she was sold to the Isle of Man Steam Packet Company.

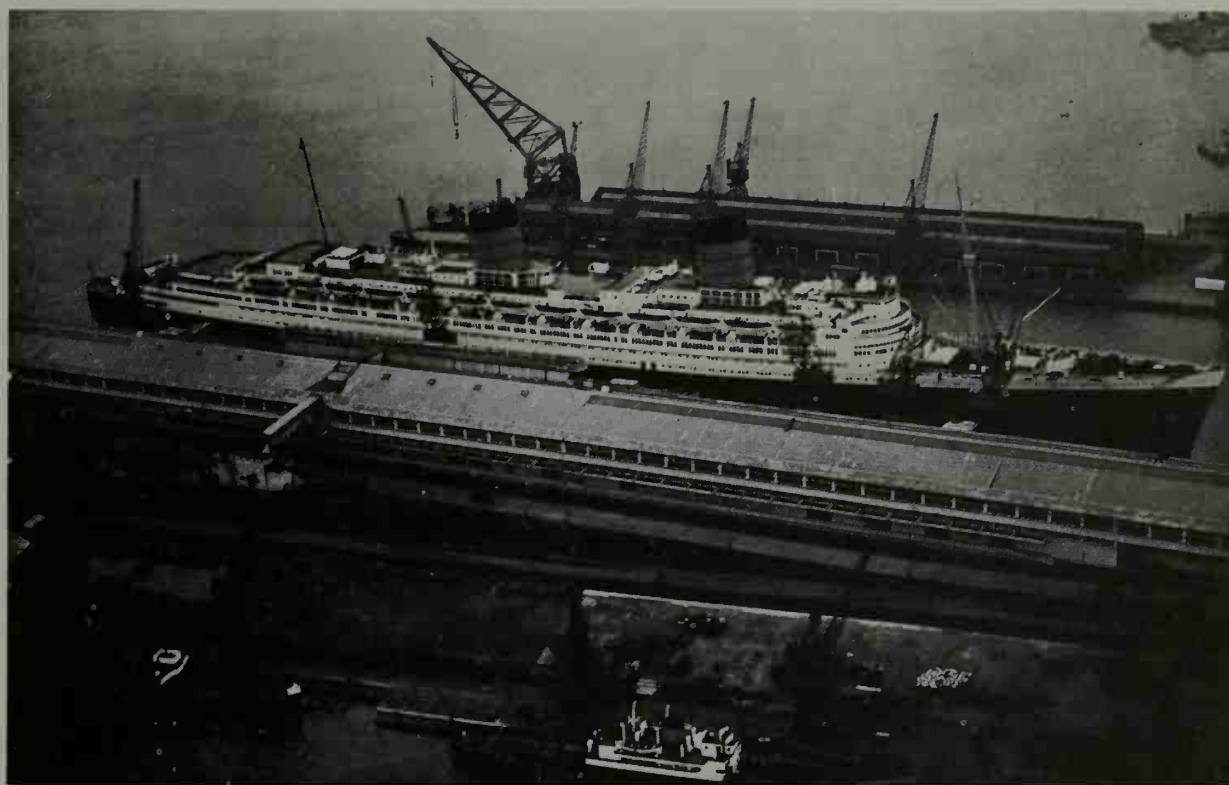
319. Immingham was a strictly railway port; the Great Central company made it. Here (July 22, 1912) King George V opens the new docks, steaming in on the old Humber ferry *Killingholme*.



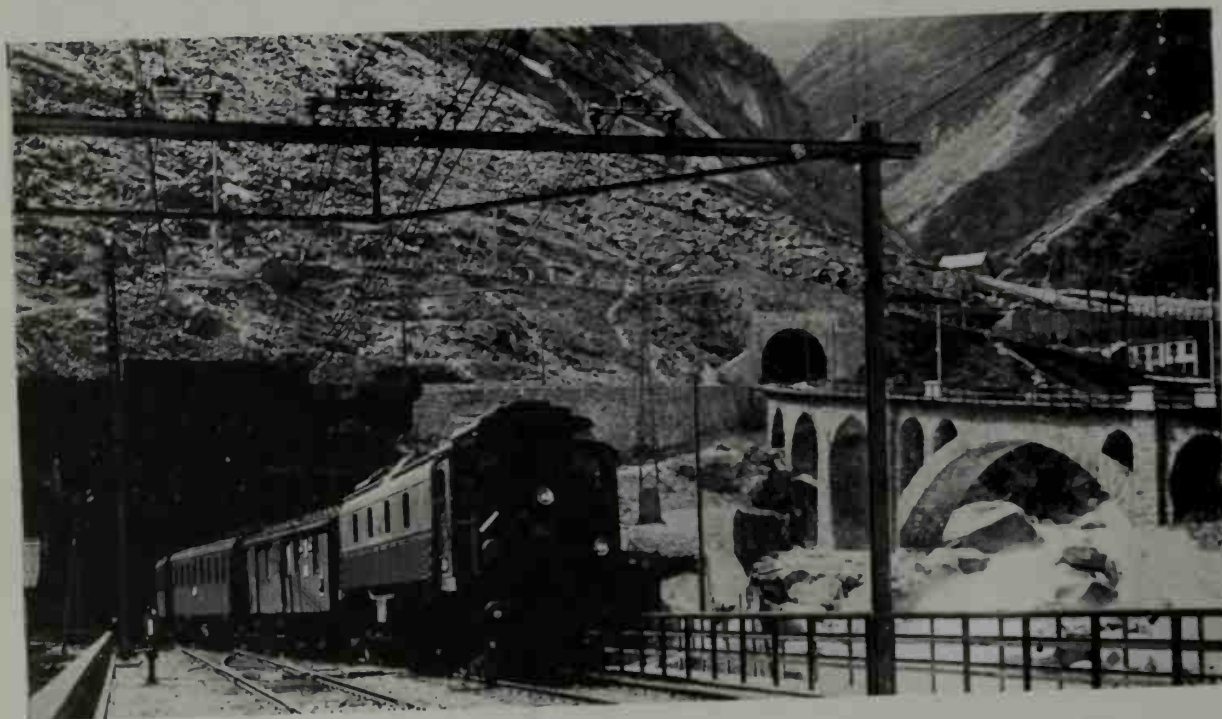


320. For a modern [railway steamer, commend us the *Amsterdam*, built for the Harwich-Hook of Holland night service in 1950.

321. Southampton's renaissance as a seaport was a consequence of the coming of railways. It was fostered and finally purchased by the London and South Western, which laid out an enormous dock area. To this the Southern Railway added, reclaiming vast areas of salt marsh at the head of Southampton Water, and finally building the Ocean Terminal, here seen with the *Queen Elizabeth* alongside.



322. Train ferries are old, and had their beginning on the Scottish firths in 1850. Later they were adopted in the narrow seas of Scandinavia, but they did not appear in the English Channel until the 1914-18 war. The Dover-Dunkirk train ferry, carrying sleeping cars on the night service between London and Paris, followed in 1936.



323-5. Main-line electric traction came early to the Alpine countries, but the real spate began in the nineteen-twenties. In the upper view, c. 1925, a Brown-Boveri 'Crocodile' locomotive takes a 22-coach train over the Arlberg line of the Austrian Federal Railways. In the middle is a train of the Swiss Federal Railways leaving the northern portal of the St. Gotthard Tunnel in 1922, with the Schöllenen Railway to Andermatt beyond. The lower view, taken in the nineteen-thirties, shows an apparently endless train passing Castle Chillon between Lausanne and Brigue.



326-9. Electric traction took Sweden by storm, or, in terms of hydro-electrification, by flood. With it, passenger amenities jumped out of the nineteenth century. Above, left, girls in the costume of the Dales bring coffee. On the right is an electric main-line train in typical surroundings. Below, left, is a hospital compartment for two, of great value in a country of sparse population and great distances, and on the right a toilet idyll from a mothers-and-babies-only compartment. All the interiors show third class.



330-2. On January 1, 1933, the Southern Railway extended electric traction south to Brighton and Worthing. Thereafter, practically the entire London, Brighton and South Coast system was electrified, primarily for passenger traffic, with parts of the South Western and the South Eastern lines. Above is Clayton Tunnel's grandiose northern portal. It became no longer necessary to wash the curtains in Tunnel House so frequently. In the middle is the electric Southern Belle, soon to be renamed Brighton Belle. Below is a view of London Road Viaduct, Brighton, in 1949, with a train going out to Lewes and Eastbourne. The new brick spans above the trees are replacements of those destroyed by bombing.





333-5. Under the influence of Frank Pick in the nineteen-twenties and 'thirties, the London Underground railways produced a revolution in station architecture, with new stations that were a model to the world. The upper view shows the terminus at Uxbridge; in the middle is St. John's Wood on the Bakerloo extension; below is Park Royal on the western extension of the Central Line (formerly the Central London Railway).

336. London Transport: Piccadilly Station in 1928.



337. London Transport: Bank Station in 1941.



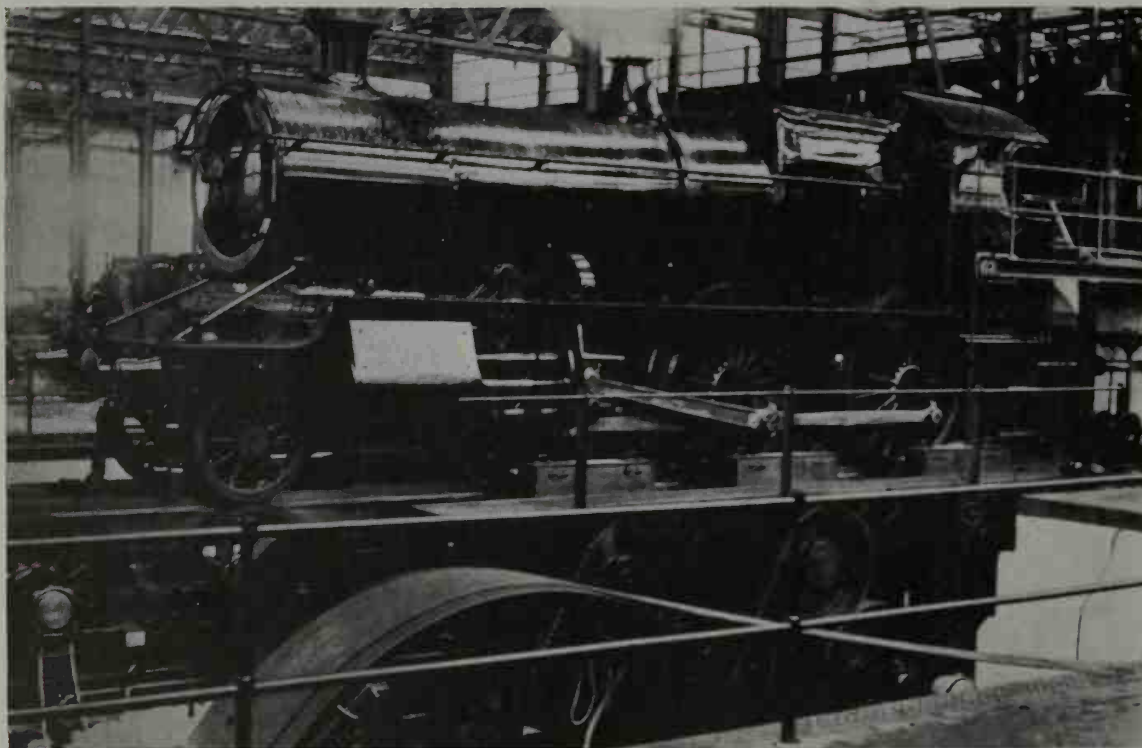
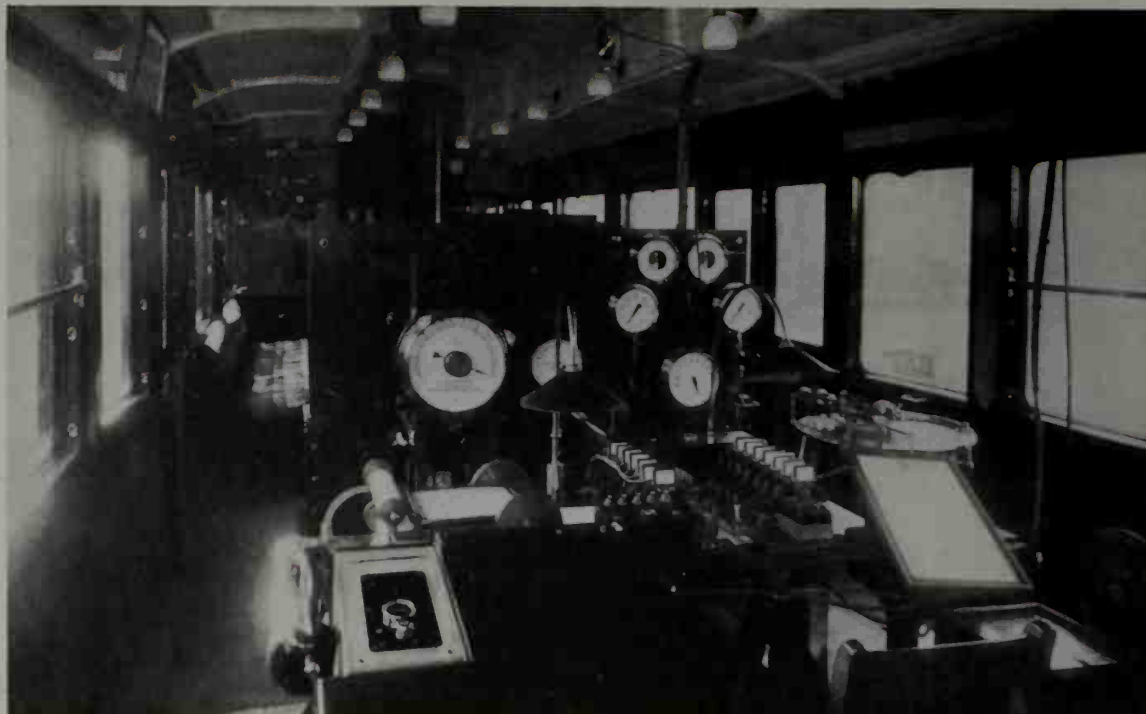
338. (*Left*) The ant-hill: London goes down by escalator, between advertisements of building societies, whiskies and corsets, to a soft train.

339. (*Above*) The termitary: Moscow goes down by escalator, amid the splendours of proletarian baroque, to a hard train.

340. (*Below*) Inner Circle. The passengers sit glumly through the rigors of a newspaper stoppage. One solitary has brought a book with her.



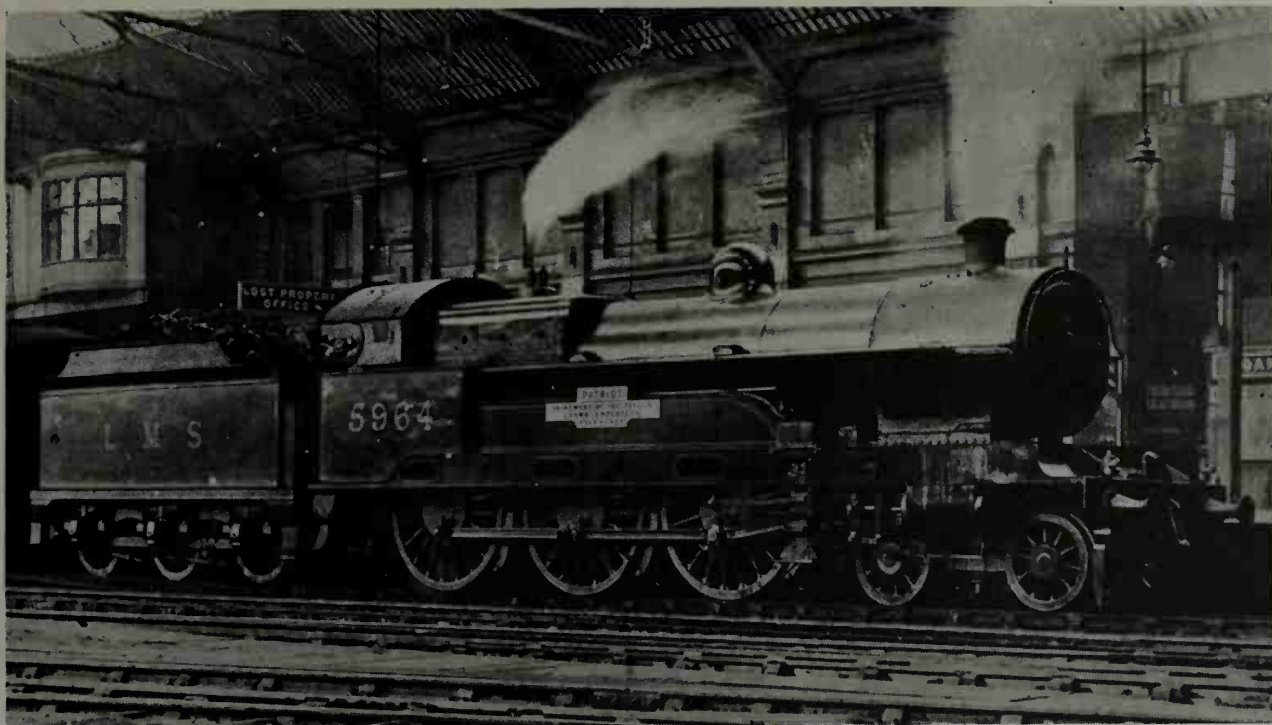
341. The Great Western Railway was the absolute pioneer of scientific locomotive testing; for it Daniel Gooch built the world's first dynamometer car in 1839. This one was the work of G. J. Churchward, and within its rather antique coachwork contains a very modern laboratory.



342. At Swindon, in the early years of the present century, Churchward installed a stationary testing plant, which was the forerunner of the much more recent testing stations at Vitry in France and at Rugby.

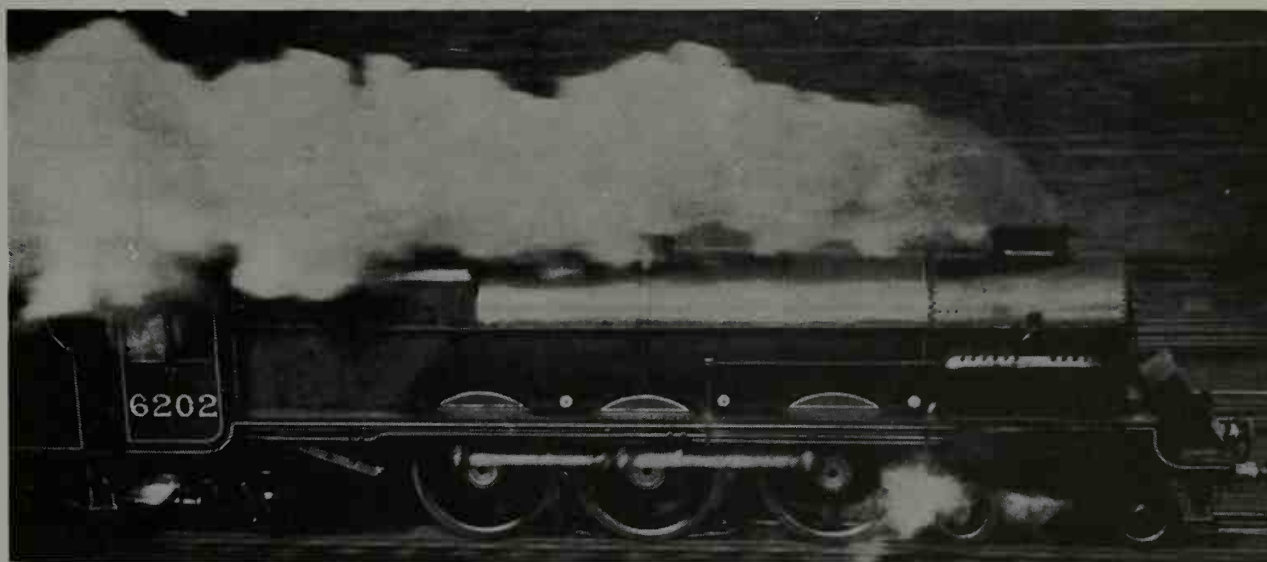
343. The ex-Great Western engine, *County of Middlesex*, with an indicator shelter on the front platform and the dynamometer car attached, passes Swindon on a controlled road test. The chimney is stripped, and the engine is passing over a ramp of the automatic train control system, another example of large-scale pioneering by the G.W.R.



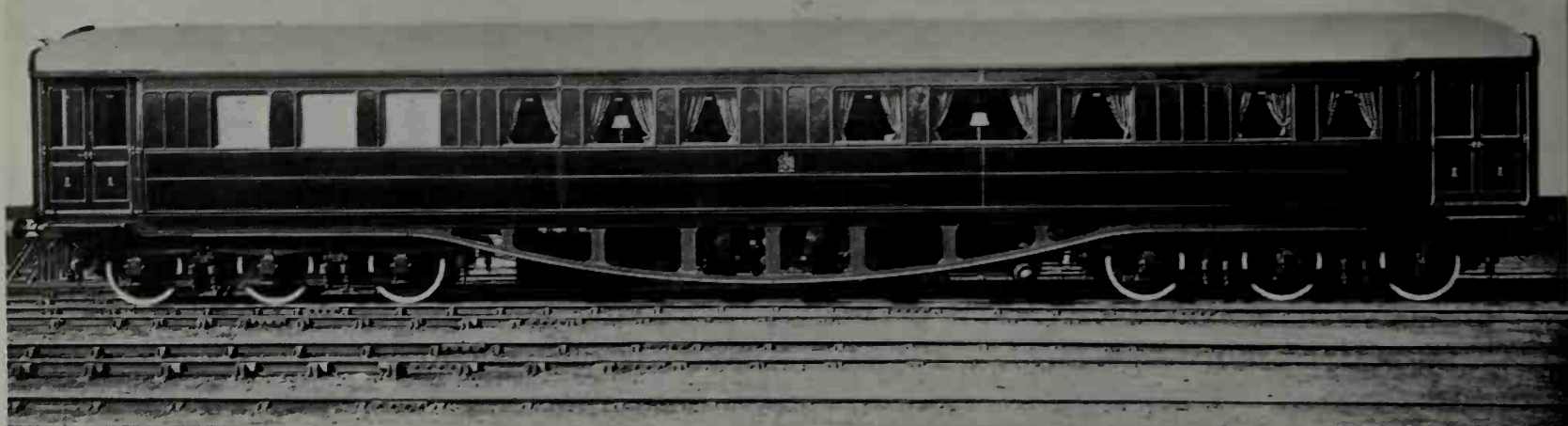


344. Memorial locomotives appeared on several railways after the war of 1918-14. This was the *Patriot* of the London and North Western Railway, at Birmingham New Street in 1931. The London Midland and Scottish company gave her an ex-War Department tender, somehow appropriate though it certainly did not belong.

345. The only permanently effective steam turbine locomotive in Great Britain was L.M.S. No. 6202, which for many years worked the Merseyside expresses. British Railways at last rebuilt her, in the interests of standardisation, as an ordinary Pacific (*Princess Anne*). Thereafter her days were sadly short, for she was damaged beyond repair in the Harrow collision of 1952.



346. Speeds of 100 m.p.h. and over had been recorded with steam earlier in the century, on the Great Western. On the northern lines they were attained on various occasions during the nineteen-thirties, in conjunction with streamlining. Sir Nigel Gresley's *Mallard* reached 126 m.p.h. on a special run in 1938. The engine is now preserved and restored. In this post-war view, the streamlining has been somewhat cut. The Pullman cars are elderly.



347-9. Edwardian royal saloons. Above is the King's Saloon of the East Coast companies. Built in 1908, it was extraordinarily advanced, and had a forced ventilation system in which the incoming air was warmed before being delivered to the compartments—a fore-whiff of air-conditioning. The middle view shows the Queen's bedroom on the London and North Western royal train, built in 1903. In Queen Alexandra's time, the bed was tented. The lower view shows the exteriors of this and the King's saloon. At the request of George V, the carriages retained for many years the London and North Western colour style of white and purple lake.



350. Somehow the ladies' pot hats, and the hugely clumsy armchairs, belonged together in the Royal Scot of 1929. The chairs were too big for any save a man with very long legs; the decorative treatment was aimed at being austere dignified, and only succeeded in being dull.

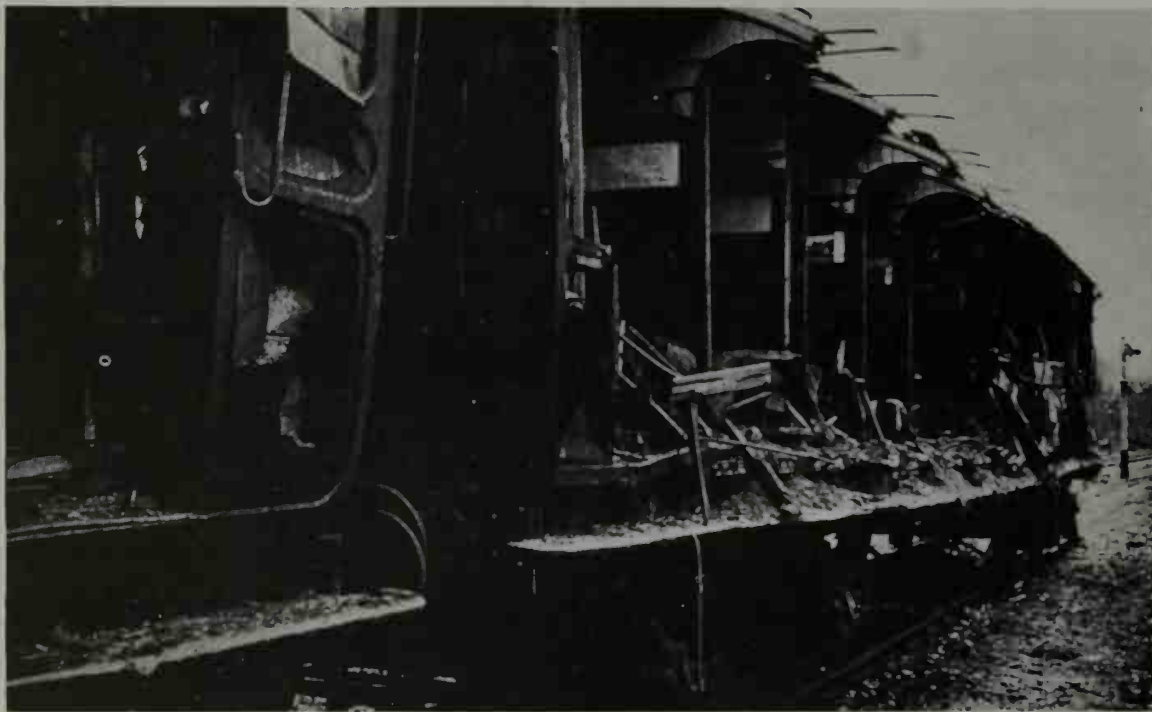


351. Very much better was the classic Pullman treatment, with excellent chairs, on a Southampton boat express of 1931.

352. South Africa remained stubbornly traditional, as in this dining car of 1925, with its mahogany pillars going up to the deck-rails. The clerestory was perpetuated, and many years later was adapted as a housing for air-conditioning ducts (see 361).



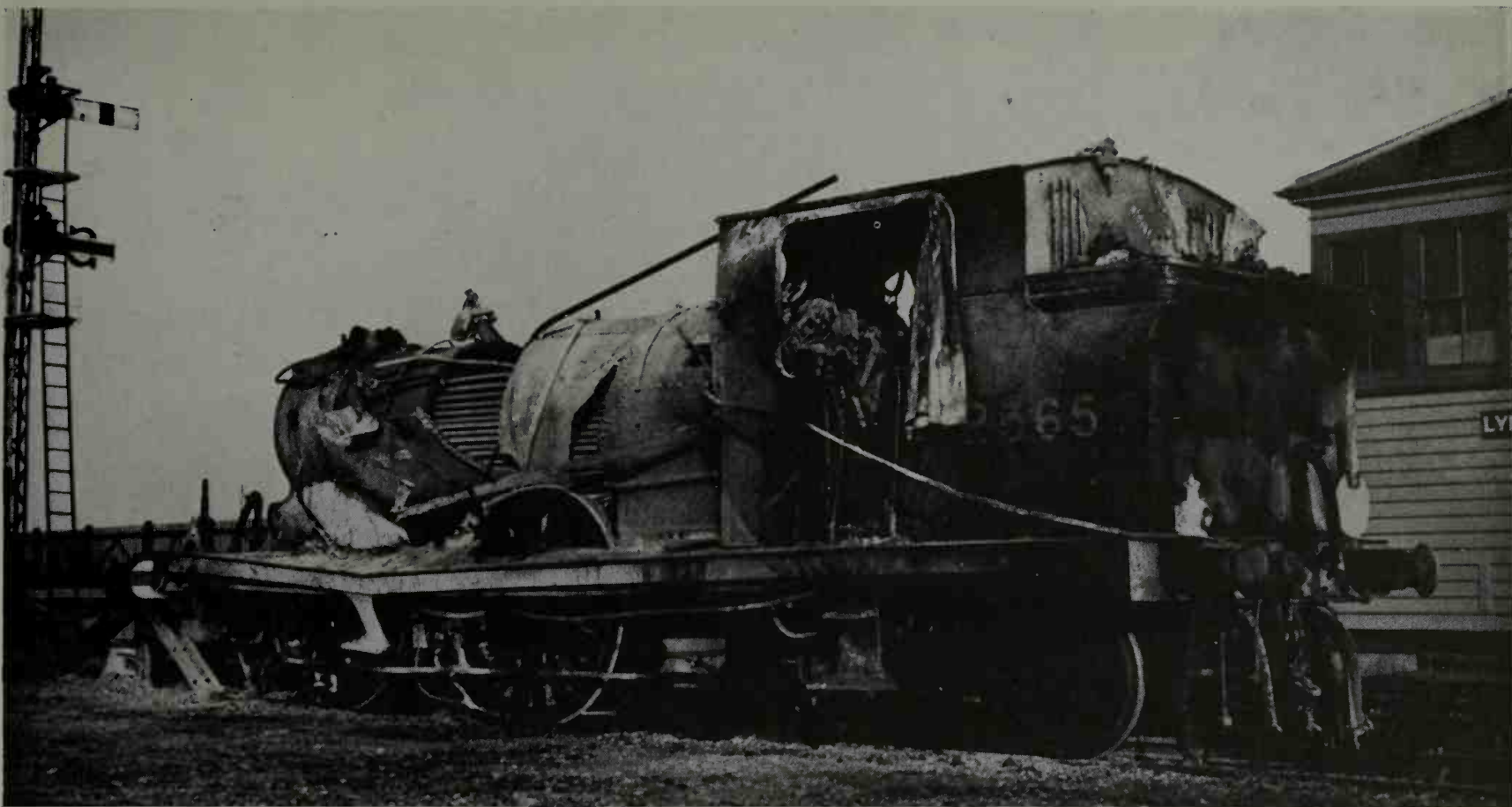
353. All British railways suffered heavy bombardment in the nineteen-forties. The Southern was in the front line. No other British railway was so badly battered, yet in repair and re-organisation the company was second to none. At Wimbledon Power Station, a bomb went clear down the north stack on October 16, 1940.



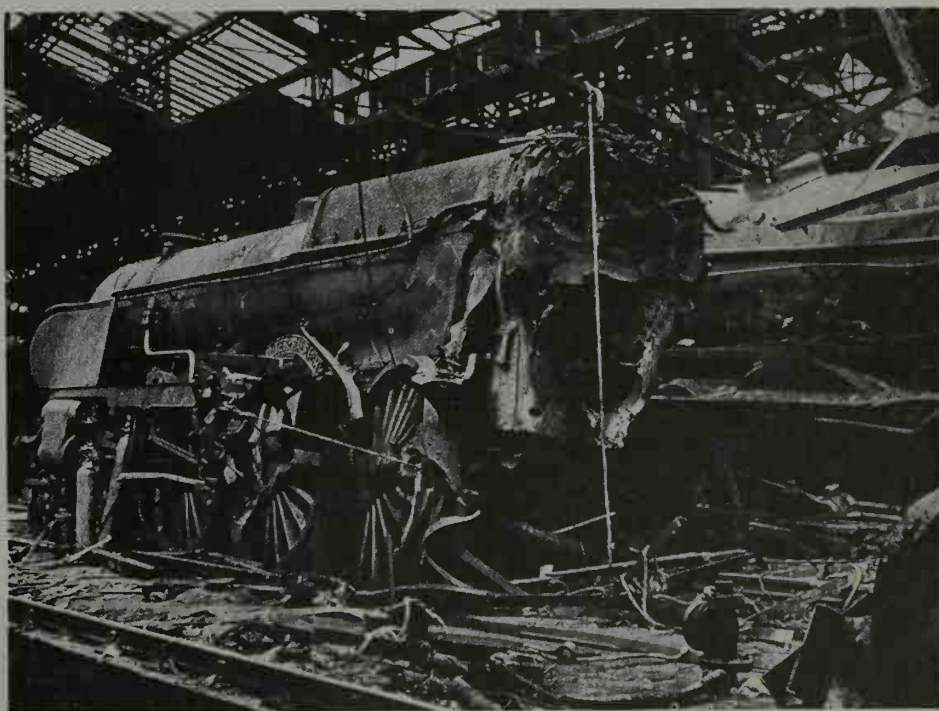
354. Nobody expected adventures on the Guildford-Horsham push-and-pull local, but it was bombed at Bramley on December 17, 1942, with severe loss of life. This was the corridor side of the train after the incident. The carriages were old London, Brighton and South Coast straight-backs.

355. By a fluke of flukes, a flying-bomb struck the suburban roads of Charing Cross Bridge in London, June 17, 1944. Beyond is Charing Cross, with a slice out of the middle from earlier bombing.





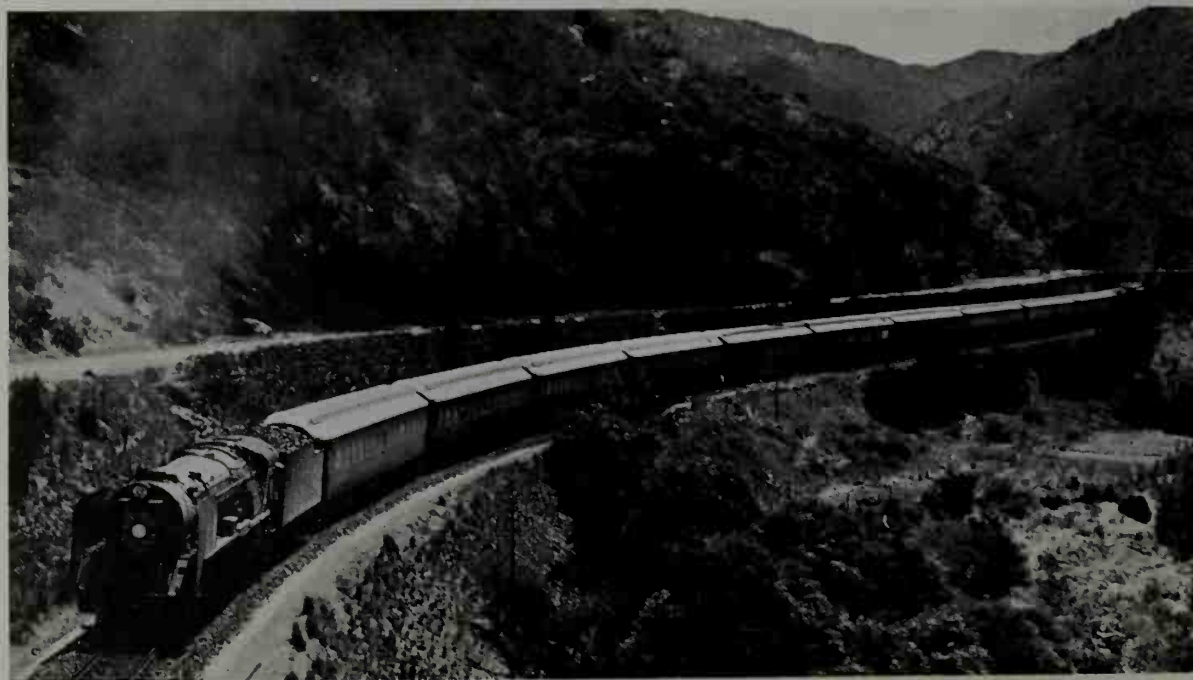
356. Queen Victoria once said: 'We are not interested in the possibilities of defeat. They do not exist.' The London, Brighton and South Coast had an old engine named *Victoria*, which it bequeathed to the Southern Railway. Shot-up on Romney Marsh, November 28, 1942, she exploded her boiler into the belly of the attacking aircraft. The aeroplane was destroyed. The locomotive was repaired.



357. (Left) Not every locomotive will survive a high explosive bomb that comes through the boiler and firebox, and bursts under the crank axle. This old T9, ex-London and South Western, did so at Fratton on January 12, 1941. Dugald Drummond's locomotives, it has been said, were built like battleships. The only sure way to destroy one was systematically to take it to pieces and then break up those.

358. (Above) At Nine Elms, on April 16, 1941, Sir Walter Raleigh had a direct hit on the back of the firebox, and, like her neighbour engine, went down into the pit. Both engines were repaired. Only one Southern Railway locomotive was written off as a result of war action.

359-61. South African Railways and Harbours, amalgamated from the Central South African, Cape Colony and Natal Government Railways, have the largest 3 ft. 6 in. gauge railway system in the world, the largest single undertaking in the Union, and are the largest single employers in the *Vasteland*. Of these three views, the first shows a train of the nineteen-twenties, headed by two Hendrie 4-8-2 engines, climbing on reverse curves at an inclination of 1 in 40. In the middle, a Beyer-Garratt articulated engine banks an express in the Outeniqua mountains. Below is the Blue Train, Cape Town to Pretoria, near Worcester, Cape Province.





362-4. U.S.A., the passing of steam. Above is the City of Portland of the Union Pacific Railroad, headed by three General Motors oil-electric locomotives working in multiple-unit. The nineteen-fifties saw an extraordinary recession in steam traction; the latter days of steam, at the same time, produced some giants, such as this 4-8-8-4 Mallet of the Union Pacific, leading a freight train through the Black Hills of Wyoming in the late 'forties. Below, a later essay, is a gas-turbine locomotive, also on the Union Pacific.

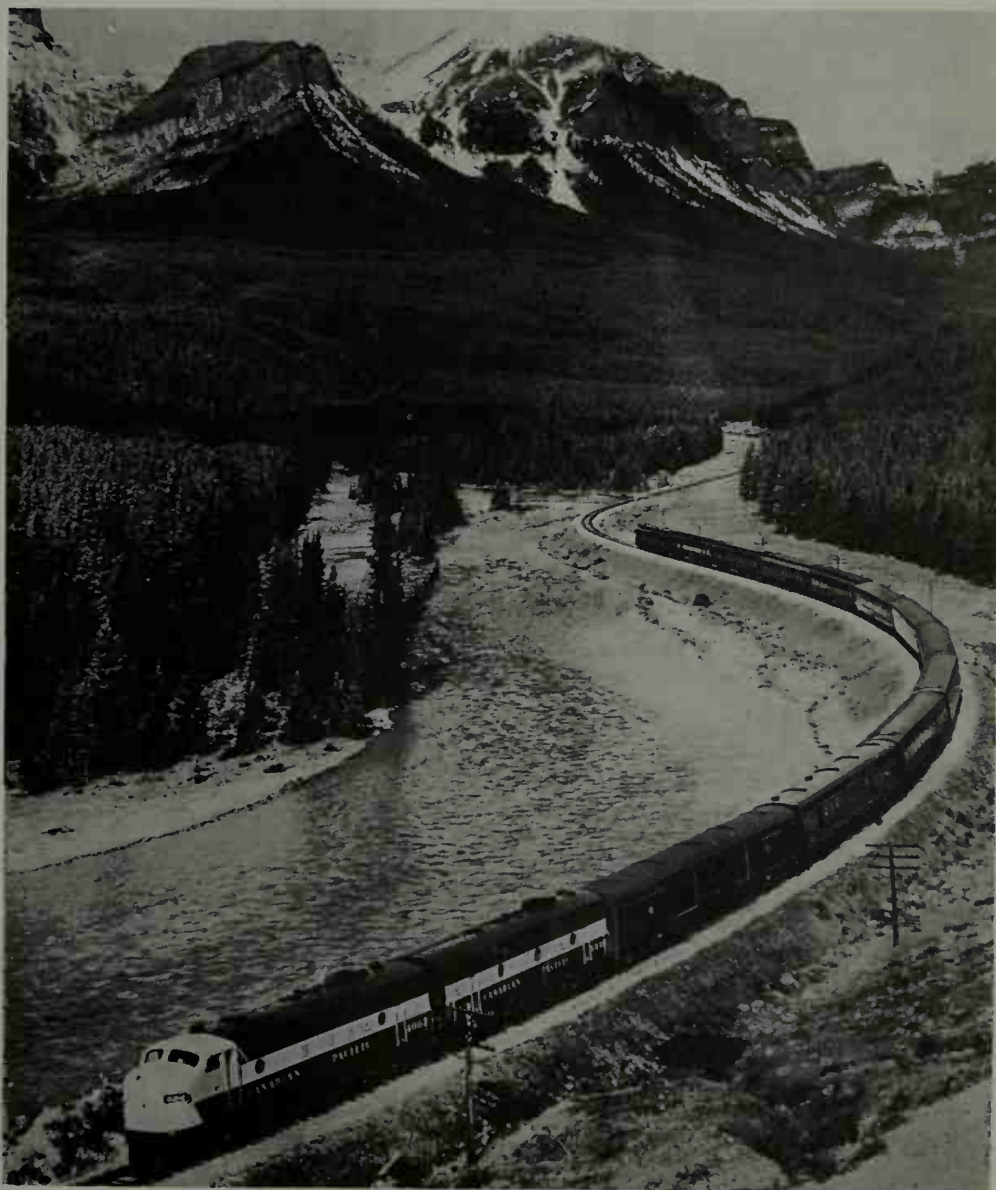




365-6. On the Canadian Pacific Railway near Field, British Columbia, in the nineteen-thirties. The engine is an oil-burner, and at the rear of the train is an open-sided observation car. The lower view, taken about 1925, also on the C.P.R. Mountain Division, shows an open platform observation car of the classic Pullman type. It could be a delightful vehicle, but was dusty in dry weather. As far back as 1902, the C.P.R. had tried the rooftop observation compartment, nowadays called 'vista-dome'—indeed, this was built in Russia as long ago as the 'sixties (see 210)—but steam traction did not agree with it.



367-8. Twilight of the Gods: In the last days of steam over the mountains, the camera looks along the sleek back of a Canadian Pacific engine heading the Dominion. The lower view, taken in 1952, shows how compression-ignition came at length to the C.P.R., first on the mountain section between Calgary and Revelstoke. A double-unit locomotive heads a twelve-car train near Lake Louise.





369. Decently conservative was Spain, where the Northern Railway, a Franco-Spanish company, produced this peculiarly French first-class carriage in 1930. Lincrustawalton and frilly lampshades persist, but the compartment is comfortable and dignified.

370. Third-class sleeping cars, long-established in Russia and Scandinavia, reached Great Britain in 1928. At first, except on the Great Western, they were made as convertible day coaches; this unconvertible L.M.S. example belongs to the middle nineteen-thirties. Bedding consists of a spring mattress, a rug and a pillow. (Russia provided these on hire, and Sweden furnished full bedding without charge.)



371. Third class on the Great Western in the nineteen-thirties. In spite of their four-sidedness and lack of intermediate elbow-rests, the seats were more comfortable *a posteriori* than on the northern lines. The same applied on the Southern Railway.



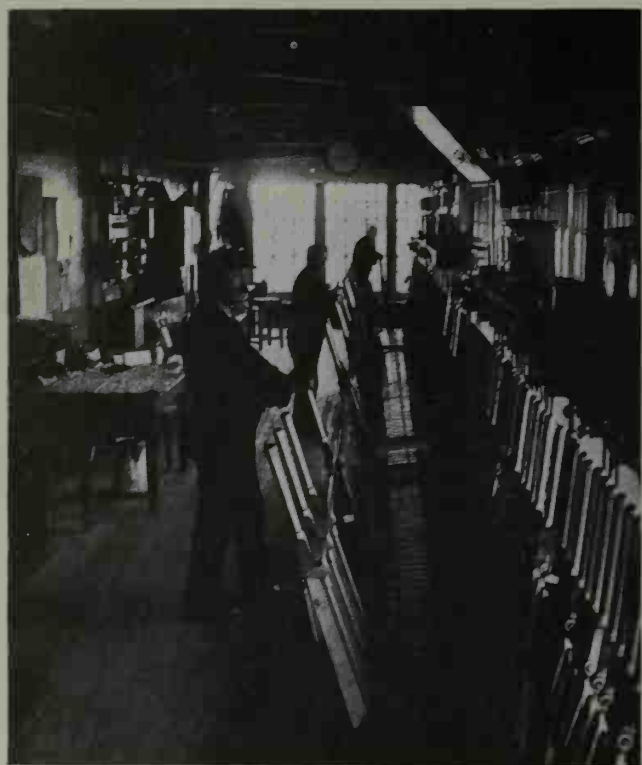
372. In marked contrast is this club bar of the Canadian National Railways, air-conditioned and decorated in contrasting woods. In keeping with North American convention, the seating is arranged for sociability rather than for looking out of windows.



373. Changing habits brought in the self-service refreshment car, of which this is a British Railways example, 1954.



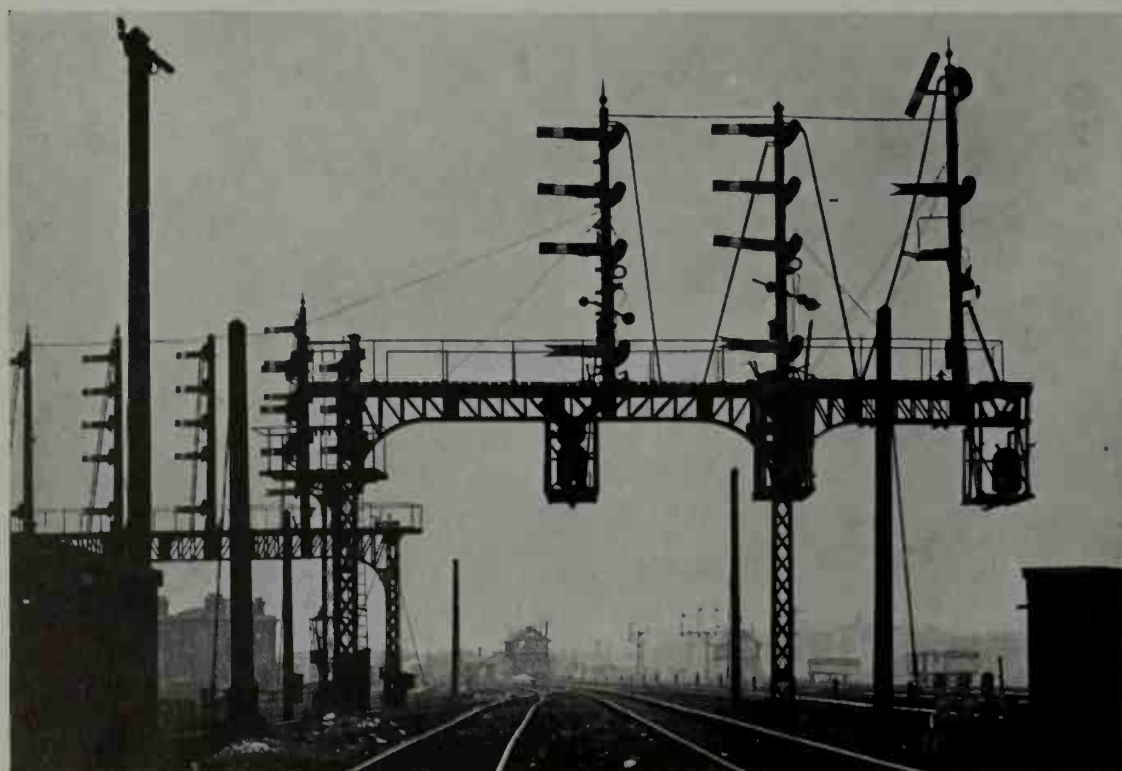
374-5. British first-class sleepers have changed in style rather than arrangement (see 191). Above the attendant's cap is the ball-and-socket joint of the forced ventilation system, arranged for warm or cool air. On the right is a superior category third-class sleeping compartment on a Scotch express in 1951. There are two berths with made-up beds, but the occupant of the lower one must still mind her head.



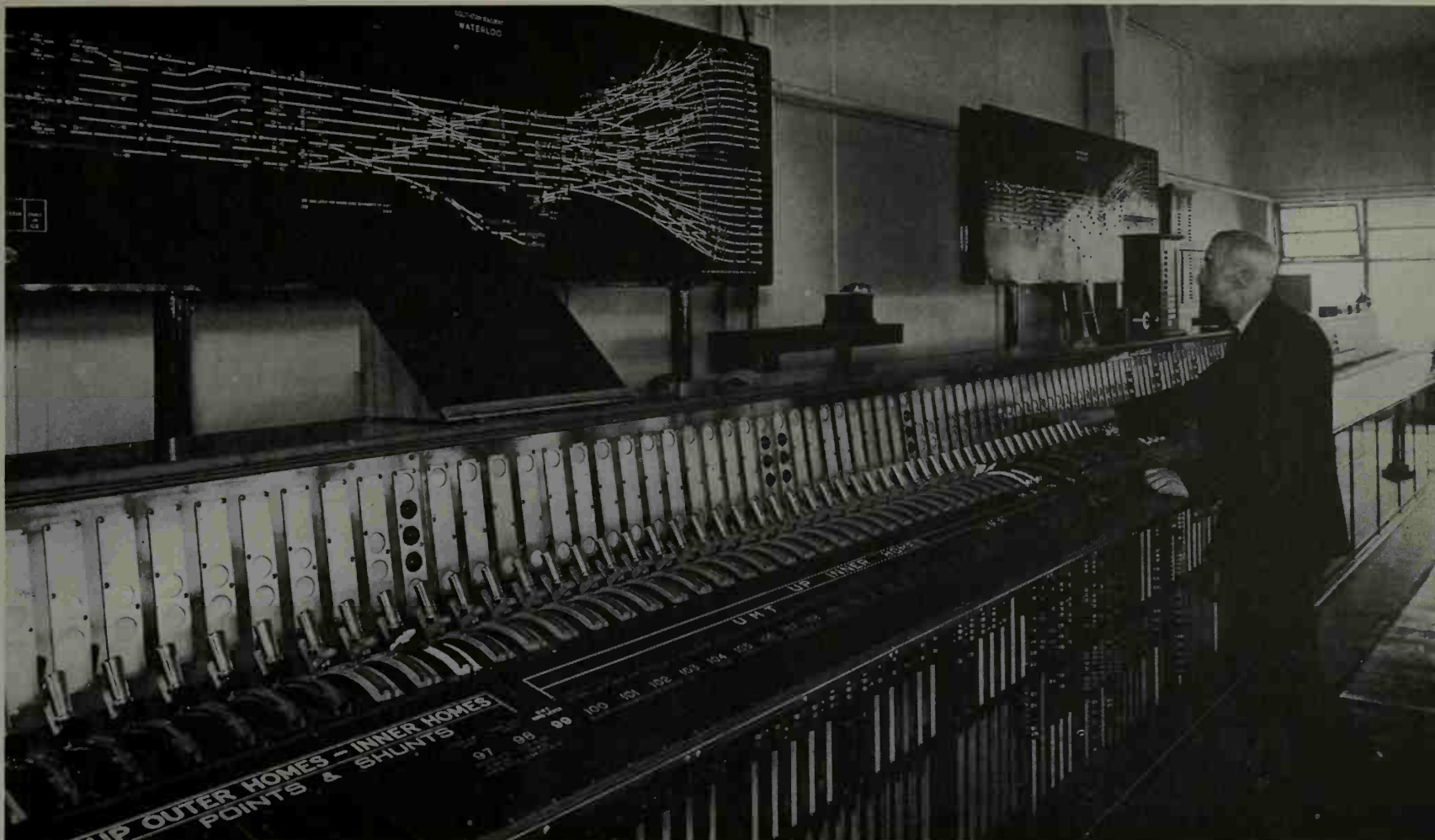
376-7. From earliest days, British signalling methods and equipment led the world. This was the old manual signalbox at Liverpool Street on the Great Eastern, which contained 165 levers, controlled the most intensive traffic in the world, and was worked by three men. Later semaphores work in the upper quadrant, except on the former Great Western lines. This is in the Southern Region at Farnborough North.



378. Signal gantry at the south end of Rugby, London and North Western Railway. The semaphores were duplicated, in two ranges, owing to interference by the bridge carrying the Great Central main line.



379. Typical of the Great Northern Railway were French's balanced semaphores, or 'somersault' signals, some survivors of which are here shown at Finsbury Park. They were used also in Northern Ireland, South Wales and New Zealand. Under the Finsbury Park gantry are new colour-light signals about to be brought into use.

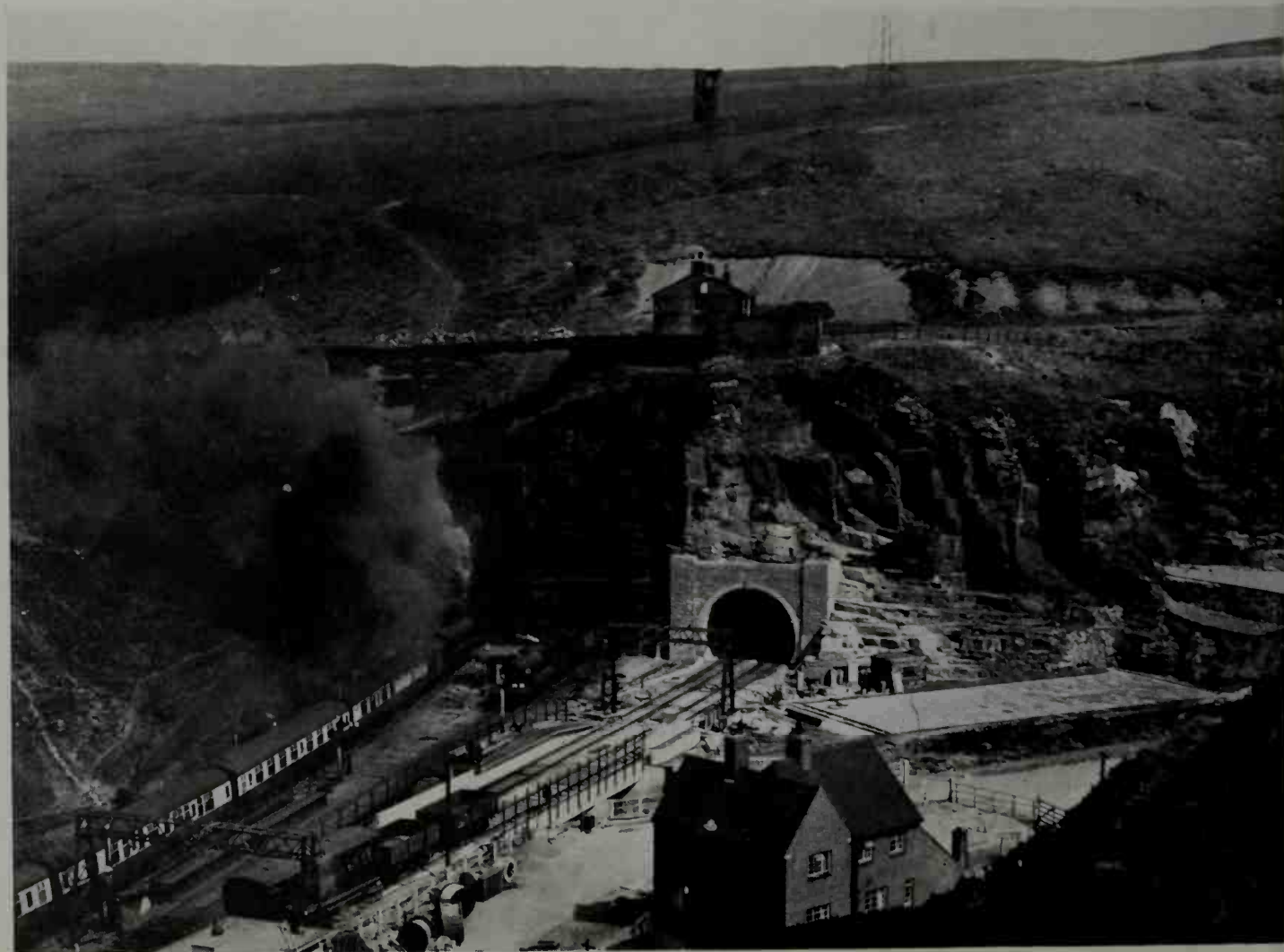


380. The great electric signal box at Waterloo, Southern Railway, with its illuminated track diagrams, in 1936. It replaced six manual boxes, and the change-over to electric colour-light signalling was made in the small hours of October 8, between the 12.35 a.m. train to Hampton Court and the 1.30 a.m. to the West of England.



381-3. Colour-light signalling, separate from the use of semaphores, is an idea of some antiquity, but automatic electric installations on a large scale belong to our own time, like the signalling of road crossings. On the left is the up starter at Wivelsfield on the Brighton main line; in the centre are up starters at Brighton; on the right is a bracket signal at Bristol Temple Meads. Unlike semaphores, they are not photogenic. Light, shade, steam and the skill of Mr. Heiron make the right-hand view, in which a British Railways standard 4-6-0 heads an up fast goods.

384-5. Metamorphosis of Woodhead. The first of the great, smoky, twin tunnels through the Pennines between Woodhead and Dunford Bridge was opened in 1845. Just over three miles long, it was then the longest tunnel in the world. The upper view shows the Woodhead portals in 1903. Only a Victorian English railway company could have built Woodhead station like a castle, and then had it adorned with an advertisement for Epps's Cocoa! The London and North Eastern company began the electrification of the Great Central Manchester-Sheffield line, but it was suspended through the war years. The lower view, taken in 1954, shows two of the last steam trains entering and leaving the old tunnels. On the right is the new, virgin tunnel, which has never known steam.





386-7. Electric traction through the Pennines. In 1954, British Railways completed the electrification of the Manchester, Sheffield and Wath group of lines with its tremendous mineral traffic. The Wath lines came first. In this view, taken on a bleak January day of 1952, a Bo-Bo locomotive brings a coal train into Barnsley Junction, Penistone. In the lower view, on a September morning in 1954, the Liverpool-Harwich Continental Express, headed by a Co-Co locomotive, comes purring up the Great Central main line through Oughtybridge. Unlike those of some foreign countries, especially France, electric locomotives of British Railways have less than the slightest claim to beauty so far, but at least the express engine perpetuates the oval buffers of the long-vanished Great Central company — perhaps by accident?





388-90. Past and present in Russia: Among various legacies of the Empire is the Kursk Station in Moscow. Blandly Alexandrine in a Marxist city, it faces its superb square. The country station in the middle is at Kislovodsk, a spa on the north side of the Caucasus. A stout old Wagons-Lits car waits among typical Russian 'hard' coaches. Below is a night scene at a country station in the last century, from an oil painting, apparently of the 'seventies, in the possession of Henry Maxwell.



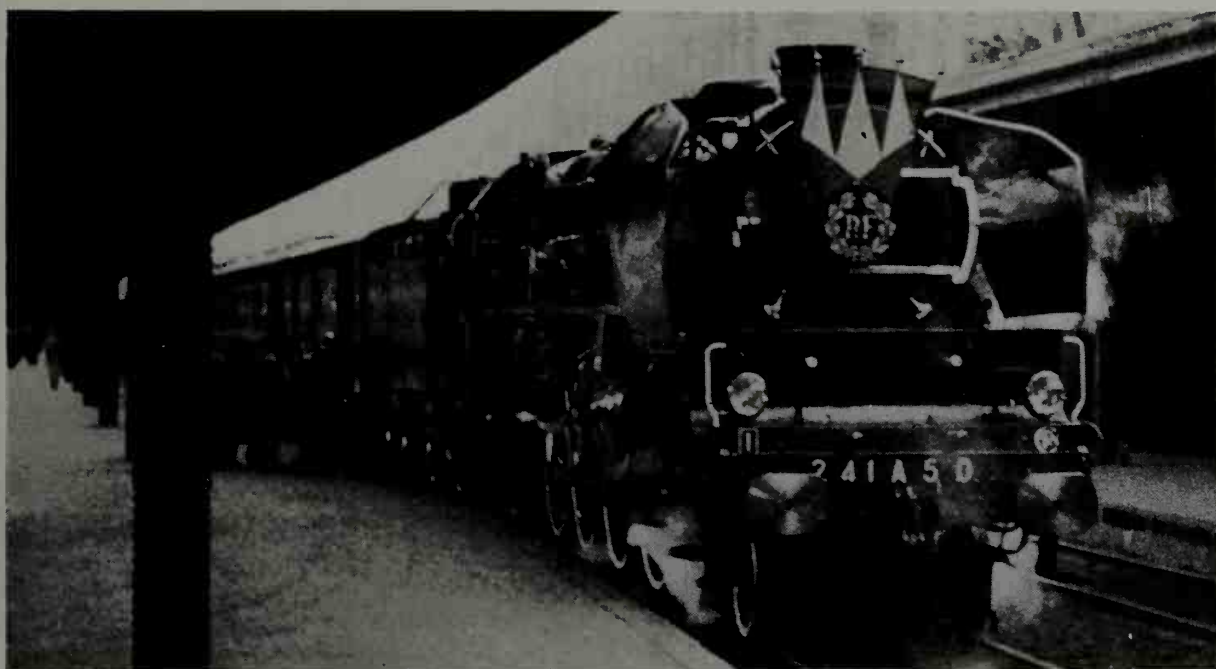


391-3. In the middle nineteen-fifties, the Soviet Union officially began to run-down steam traction. Its champion there was retired in what might be called honourable disgrace, like some other great Russians. The last steam locomotives appeared during the years 1956-7. Class LV (above) emerged from Voroshilovgrad in 1952 and achieved standardization, being produced up to 1956, but at least two years before, the Diesel in the lower figure had portentously appeared. Apart from engines, Sochi Station in the Crimea (middle) may not be everybody's wedding-cake, yet by comparison much contemporary Western design is dim, dour and dreary as only steel, glass and concrete can make it. The station was completed in 1953.



394-6. Nowhere in the world, before recent things in Japan, have more startling advances been made, in the handling of long-distance surface transport, than in France, since the war that wrecked much of her railway system. Electric traction has spread far. In the upper view, the Mistral, fastest express train in Europe, gleams defiantly amid the rain. The locomotive is similar to one of those which reached a maximum speed of 205 m.p.h. on trial between Bordeaux and Dax on March 29, 1955. In the middle view, a rather older 2-Do-2 locomotive pulls out of the Gare de Lyon in Paris with a train for south-eastern Europe via the Simplon. Below is a train on the line between Aix-les-Bains and La Roche-sur-Foron, the first to be electrified on a new system with a very high voltage at contact line and a corresponding diminution in the number of sub-stations. The system was later taken up in the Valenciennes-Thionville industrial area, to spread further in France and to other countries including Great Britain, where it applies from London to the North (including the Midland cities) and more modestly in the East.

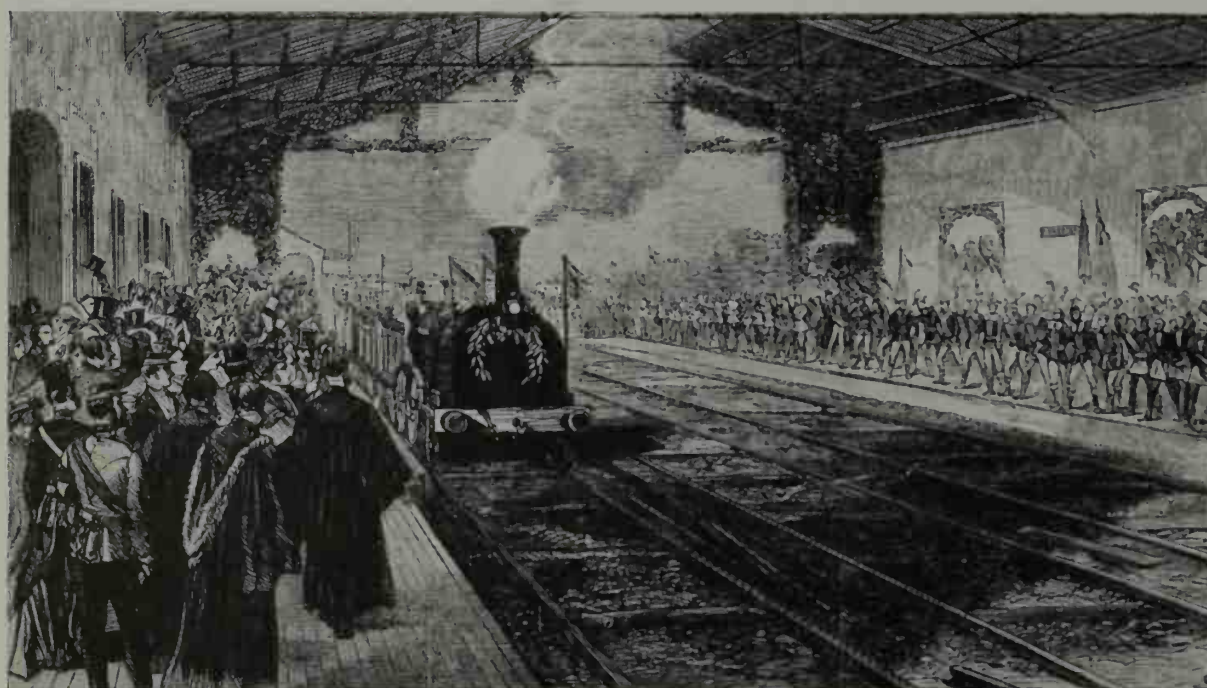




397-9. On French lines remaining without electric traction, much passenger traffic is handled by *autorails*, light oil-engined cars and trailers. The upper view shows such a train on fast inter-city work. Below, a local *autorail* slips quietly out of Antibes. Steam retreats with dignity: the middle view shows a Mountain type engine at the Gare de l'Est in Paris, about to take President Coty on a ceremonial journey to Strasbourg.

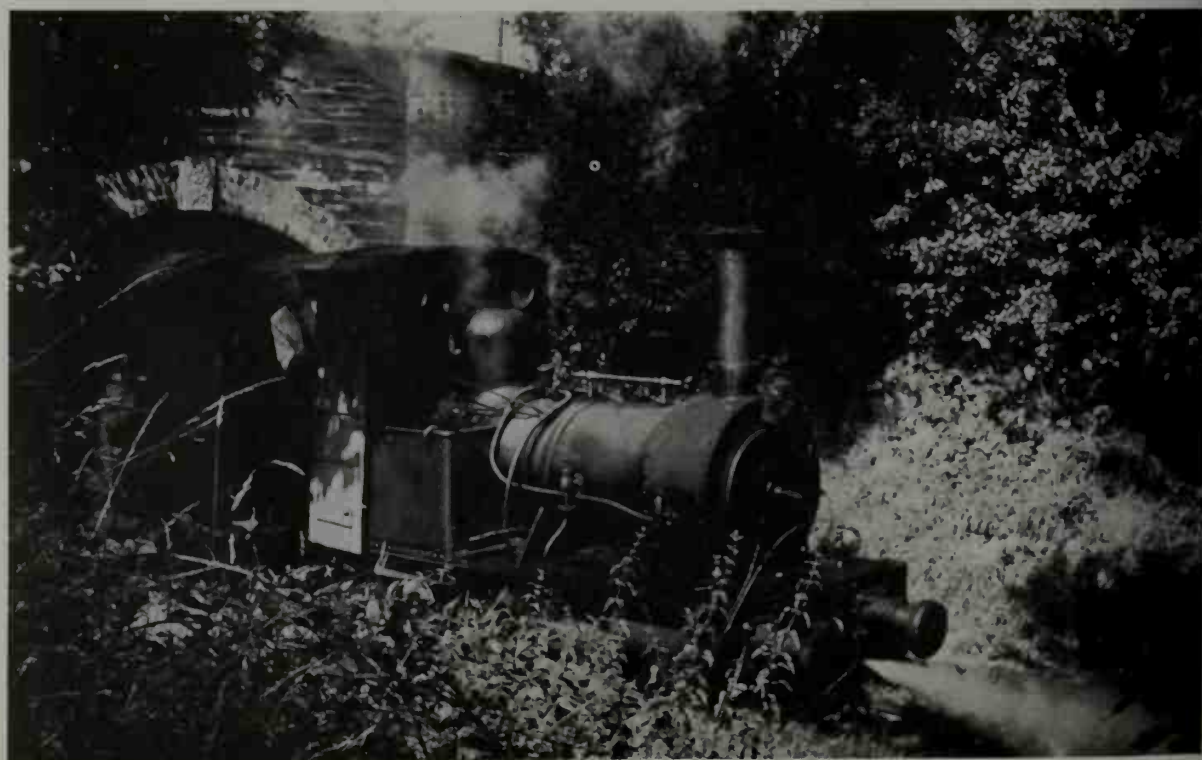


400. Local postcard of the Southwold Railway by F. Jenkins (1912).



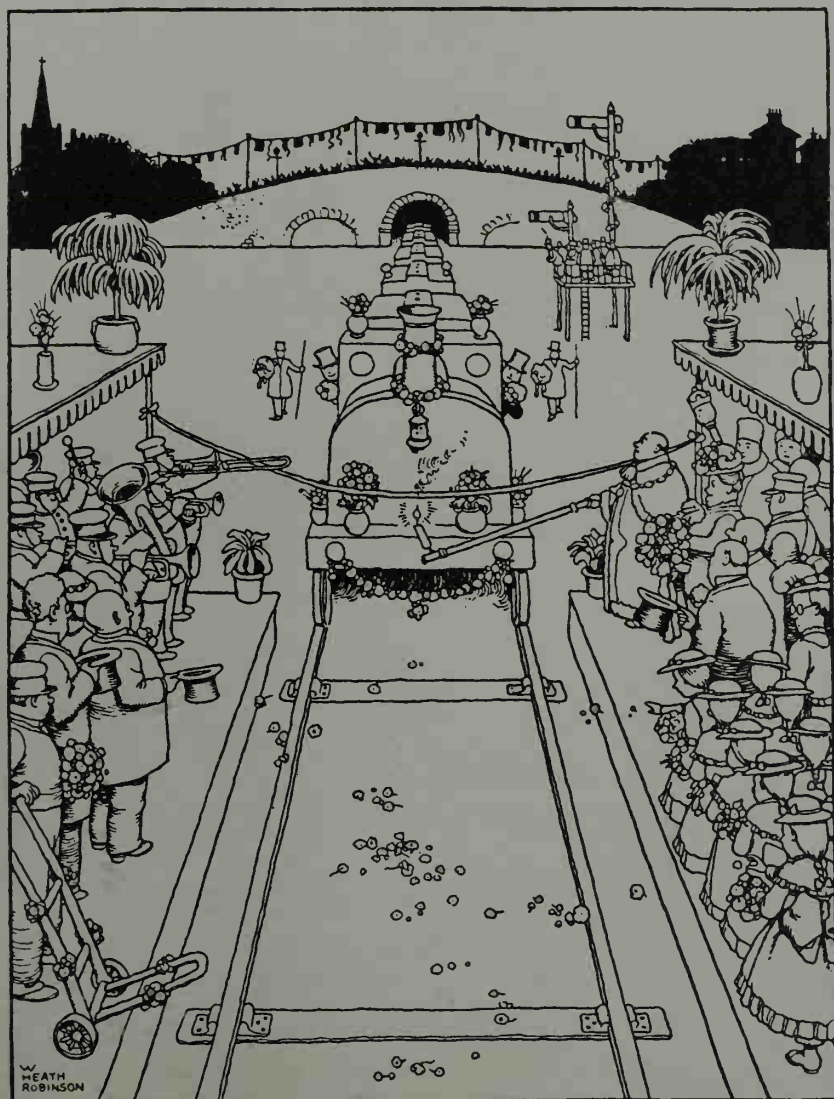
401. A picturesque ceremony: The Mayor in State receiving the first train at Falmouth (*Illustrated London News*, 1863).

402. Mr. Rowland Emmet drives a locomotive (Tal-y-llyn Railway).

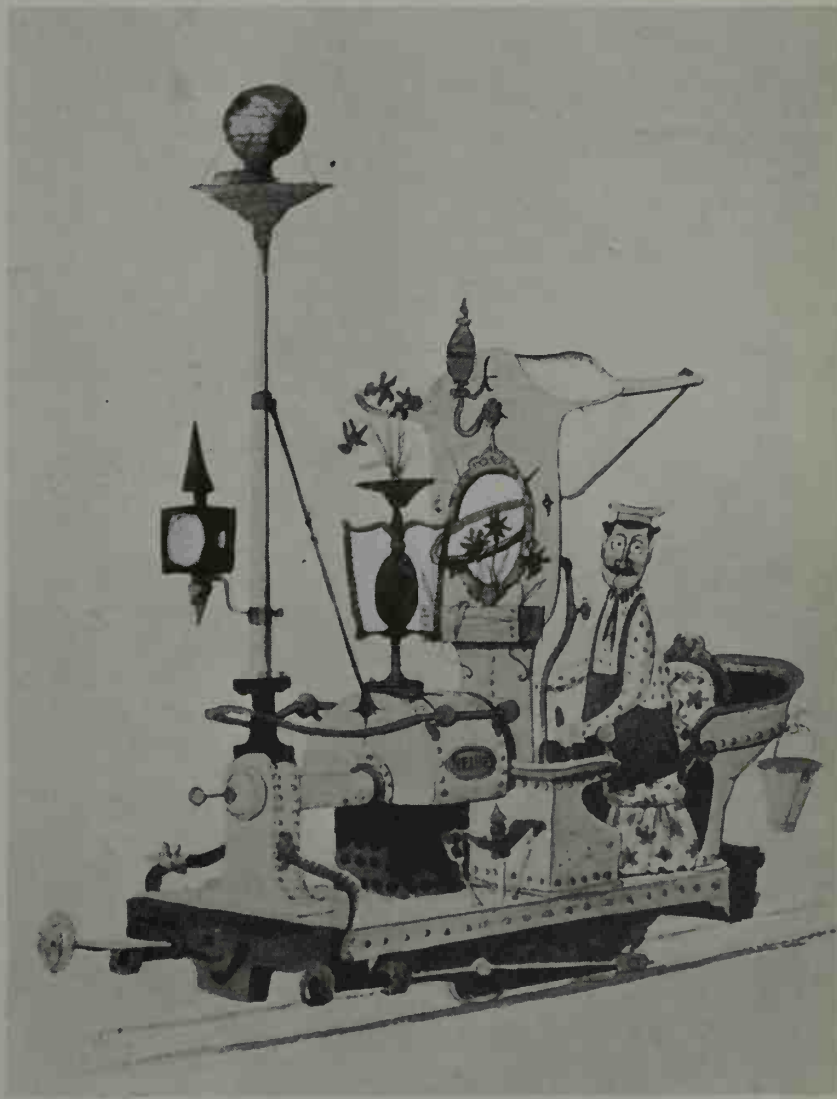




403. Local postcard of the Southwold Railway by Reg Carter.



404. A picturesque ceremony: The Mayor in State letting through the first train in a new railway station (W. Heath Robinson in *Railway Ribaldry*, 1935).



405. Mr. Rowland Emmet designs a locomotive.

406-7. We close our story with the early nineteen-fifties, just a century and a half after Dick Trevithick first put steam on rails. In 1955, British Railways proclaimed the end of the steam locomotive era. Presently in the ascendant are the electric train and the oil-electric train. In the upper view is the first of a series of two-car units built by British Railways in 1954. There are two Leyland under-floor engines to each car, and four sets can form an eight-coach multiple-unit train. The lower view shows the English Electric Company's *Deltic*, the most powerful single-unit oil-electric locomotive in the world, on trial with the Merseyside Express in December, 1955. It weighs 106 tons and can develop 3,300 h.p. from its two 18-cylinder Napier engines.



408. With a first-class carriage of the eighteen-fifties, once belonging to the London Brighton and South Coast Railway and photographed at the back of a farmyard at Wivelsfield, Sussex, a century after, we can appropriately put the word:

FINIS

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